11824

# NOAA Response to Spills of Oil and Other Hazardous Substances

U.S. National Oceanic Atmospheric Administration
...al Research Laboratories

11824



Project Development Plan



# NOAA RESPONSE TO SPILLS OF OIL AND OTHER HAZARDOUS SUBSTANCES



Prepared by:

Office of the Assistant Administrator
for Research and Development

and

Marine Ecosystems Analysis Program Office
Environmental Research Laboratories

March, 1978

U.S. National Oceanic and Atmospheric Administration
Environmental Research Laboratories

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Rockville, Maryland 20852

March 9, 1978



To: Distribution

From: Edward S. Epstein
Acting Assistant Administrator, R&D

Subject: Draft Program Development Plan (PDP) for Hazardous Materials Response Project

Attached is the draft Program Development Plan for the Hazardous Materials Response Project, a FY 79 initiative, prepared by the Marine Ecosystems Analysis (MESA) program and the Marine Environmental Assessment Office. This document not only explains the NOAA project being implemented to respond to spills of oil and hazardous materials, but also the multiagency program being organized. This effort augments the present mechanism established under the National Contingency Plan.

We are sending this document out for wide review because it affects a large number of elements of NOAA. Due to other commitments related to this project, there is a short time frame for review. Because of this short turn-around, we have sent copies directly to NOAA elements we feel should review this. If there are other offices that should be involved, we would appreciate your forwarding a copy to them or contact RD3 for additional copies. Comments should be sent to the appropriate Assistant Administrator by March 20. Consolidated comments from the Assistant Administrators should be sent to RD3 (443-8963) by C.O.B. on March 22.

If you have any questions, please call Dr. Joseph Angelovic (443-8963).

Attachment

Distribution:

| | | | |
|---|---|---|---|
| Ax1 | FAK (6) | RF28 | D2 |
| F | CZ | W | |
| F53 | SG | W16 | |
| F11 | OAS | W1 | |
| F12 | OE | WFE | |
| F13 | OE1 | WFS | |
| F14 | Rx1 | WFW | |
| FNW | Rx4 | WFA | |
| FSE | RFx41 | WFP | |
| FNE | RF20 | Ocean Management | |
| FSW | RF24 | D | |

TABLE OF CONTENTS

# I. INTRODUCTION

## PURPOSE

The National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 1510; February 10, 1975) (referred to subsequently as "The National Contingency Plan") is the principal Federal mechanism for operations undertaken in response to pollution discharges occurring in navigable waters, adjoining shorelines and high seas of the United States. The National Contingency Plan establishes an interagency capability for operations pertaining to the identification, containment, and cleanup of spills and related mitigation activities. Although the National Contingency Plan briefly considers environmental damage assessment and the need for effective use of scientific resources, it primarily deals with pollution mitigation operations rather than with the broader environmental consequences of spills.

The *Argo Merchant* incident and other recent spills revealed serious deficiencies in the organization of scientific efforts associated with major pollution discharges. Scientific resources aimed at directly supporting spill cleanup operations or those intended to enhance the present understanding of the environmental consequences of pollution discharges have often been applied in an untimely, inefficient or ineffective manner. Internal NOAA review of these pollution responses and interagency evaluation of the use of scientific resources has resulted in efforts to improve scientific response capabilities in three general areas: 1) assistance to the Federal On-Scene Coordinator who is in charge of cleanup and containment operations; 2) assessment of environmental damage; and 3) capitalization on the research opportunities offered by these spills. Under the auspices of the National Response Team, the Federal coordinating body for pollutant spill responses, EPA and NOAA have taken the lead in 1) establishing a mechanism that will provide a rapid scientific response, and 2) developing a plan that will effectively address the three areas identified above.

Subsequently, NOAA has proceeded to establish an internal response plan and to assist in the organization of an interagency mechanism that will allow effective implementation of Federal scientific resources in the mitigation of impact and cleanup and containment of pollutant spills. Because of relative agency capabilities and resources, NOAA has the lead in developing scientific response plans for spills occurring in marine waters and the Great Lakes and EPA for spills occurring landward of the baseline from which the territorial sea is measured.

This document is a first effort to define this interagency program and expand the previous contingency mechanism implemented under the NCP. Since its inception, the program has been so rapidly evolving that no document exists which accurately traces the development and rationale of the program and the system being organized to respond to the problems identified during the *Argo Merchant* incident. This Program Development

Plan (PDP) addresses the evolution, objectives and general framework of this interagency program and describes the NOAA project being implemented to support this Federal effort.

LEGISLATION

NOAA's efforts in developing a scientific capability to respond to pollutant spills in marine waters is based on several legislative responsibilities and programs relating to these mandates.

The overriding legislation which forms the backbone for the interagency response program is the Federal Water Pollution Control Act, as amended, (P.L. 92-500). Section 311 of the Act requires the preparation and publication of a National Contingency Plan (NCP) for the removal of oil and hazardous substances. The NCP provides a system of coordinated, integrated response by departments and agencies of the Federal government to protect the environment and minimize damage from pollutant discharges. The plan designates a Federal On-Scene Coordinator (OSC) to coordinate all pollution emergency response activities. The OSC reports to and receives advice from a Regional Response Team (RRT) composed of representatives from state government and appropriate Regional and District offices of Federal departments and agencies. National level coordination is accomplished through the National Response Team (NRT) which receives reports from and renders advice to the RRT. It serves as the national body for planning and preparedness actions prior to a pollution discharge and for coordination and advice during a pollutant emergency. The NRT is also responsible for conducting a continuing evaluation of response actions and making recommendations to the appropriate agencies related to improving response capabilities.

The NCP defines the responsibilities of major Federal agencies in responding to a spill in accordance with their legislative responsibilities and capabilities. Responsibilities of the three major agencies in the scientific response program, USCG, EPA, and NOAA are indicated below:

The NCP defines the responsibilities of the *Department of Commerce* through NOAA, as providing support and advice to the NRT, RRT, and OSC with respect to marine environmental data; living marine resources; current and predicted meterological, hydrologic and oceanographic conditions for the high seas, coastal and inland waters, and maps and charts, including tides and currents for coastal and territorial waters and the Great Lakes.

The *Environmental Protection Agency* is responsible for providing expertise regarding environmental effects of pollution discharges, environmental pollution control techniques, including assessment of damages, and the degree of hazard a particular discharge poses to the public health and safety. EPA is also responsible for providing the OSC, chairing the RRT, and developing and revising regional plans for inland areas.

The *Department of Transportation,* through the U.S. Coast Guard, supplies support and expertise in the areas of port safety and security, marine law enforcement, navigation and construction, manning, operation, and safety of vessels and marine facilities. The USCG also maintains continuously manned facilities capable of command, control and surveillance for all discharges on the high seas or in waters of the United States. The USCG is responsible for providing the OSC, chairing the RRT, and for developing and implementing regional response plans for the coastal waters and the Great Lakes.

There are several other legislative mandates which provide further impetus to NOAA's involvement in marine pollution incidents.

The Fishery Conservation and Management Act of 1976 increased NOAA's responsibilities in the fisheries area. The act establishes a 200 nautical mile Fisheries Conservation Zone, assigns management responsibilities to the Secretary of Commerce, requires development of fishery regional management plans, and further requires that these plans take into account contingencies in fisheries and fisheries resources. This Act also authorizes the Secretary to promulgate emergency regulations amending the fishery plans whenever an emergency involving any fishery resource is found to exist. The Secretary also is required to conduct research on the effects of marine pollution on the fisheries stocks in order to support the proper regulation of fisheries stocks in those areas affected by pollution.

The Marine Protection, Research, and Sanctuaries Act of 1972 (Title II), often referred to as the Ocean Dumping Act, directs the Secretary of Commerce, in cooperation with the Administrator of EPA and the Secretary of Transportation to initiate a comprehensive and continuing program of monitoring and research regarding the effects of dumping into ocean waters (Section 201). The Secretary of Commerce, in consultation with other appropriate Federal entities, is directed to initiate a comprehensive and continuing program of research with respect to possible long-range effects of pollution, overfishing, and other man-induced changes of ocean ecosystems (Section 202).

The Coastal Zone Management Act Amendments of 1976 authorize the Secretary of Commerce to provide grants to coastal states which have suffered, are suffering, or will suffer unavoidable loss of valuable environmental or recreational resources as a result of the impact of an energy program in the coastal zone.

There are two important pieces of legislation now pending in Congress that are expected to pass during early 1978. One, the Federal Ocean Pollution Research and Monitoring Act (S. 1617) designates NOAA as the lead agency for coordinating Federal ocean pollution research. It also requires the Administrator of NOAA to prepare a 3 year plan that details Federal programs and resources in the area of marine pollution, lists goals and costs of Federal ocean pollution research and monitoring effects, and identifies and sets forth priorities for the Federal program relating to ocean pollution research and monitoring. The bill, if passed, will put NOAA prominently in the forefront of marine pollution affairs and will require the Administrator to take a strong leadership role in the coordination and implementation of a comprehensive Federal effort directed at marine pollution problems.*

Another bill which has major implications with respect to this program is the Comprehensive Oil Pollution Liability and Compensation Act (H.R. 6803). The bill provides for claims of damage for injury to, or destruction of, natural resources, allowing claims for restoration of impacted natural resources to be brought by the President or any State with appropriate jurisdiction. This bill and the Clean Water Act Amendmendments of 1977 (P.L. 92-500) are both dependent upon a proper damage assessment so that legal action can be brought against the polluter or pollution fund for costs incurred during restoration.

* On February 28, the House passed a companion bill to S. 1617 which has similar provisions. Action is anticipated by the President in March.

## BACKGROUND

Prior to the *Argo Merchant* grounding near Nantucket Island in December, 1976 no comprehensive scientific program or mechanism was either in place or planned which could effectively deal with a potential marine environmental disaster of this nature and scope. The seriousness of this shortcoming became quite clear as events unfolded during late December and early January. Had a series of rather fortuitous circumstances not combined to avert a major environmental catastrophe (most notably a sustained period of offshore winds), our relatively poor capability to deal with the incident from a scientific standpoint might have resulted in millions of dollars in unnecessary additional losses.

The problem was not that the scientific community failed to recognize the seriousness of the situation. In fact the community responded in force -- with over 200 representatives of 40 agencies and institutions at the scene in one capacity or another in the few weeks following the spill.[1] Nor was the problem one of inattention on the part of the Federal government to the problems of marine pollution. Over $70 million annually has been applied to understanding the effects of hazardous substances, particularly hydrocarbons, in the marine environment. These studies are underway in several Federal, state and academic institutions, however no mechanism existed in late 1976 to rapidly mobilize these and other related efforts into an effective response organization.

In the weeks which followed termination of the incident as an immediate threat, considerable insight was gained regarding the capability of the scientific community with respect to the problems of major marine

1. *Pollack, Andrew, 1977. Crisis Science: Investigations in Response to the Argo Merchant Oil Spill.* M.S. Thesis. *Massachessetts Institute of Technology.*

spills. The general conclusions were that:

(1) Although a great deal of scientific capability existed at the time of the *Argo Merchant* to provide assistance to those involved in cleanup, containment, and damage assessment, the Federal government was not prepared to rapidly mobilize and coordinate an effective scientific response team. Future efforts to correct this situation must first deal with a complex of institutional and organizational problems which appear to be the major deterents to an effective response;

(2) Key gaps in our understanding of the effects of contaminants must be filled if we are to effectively assist in mitigating or assessing damage resulting from such incidents.

These problems have been actively under study since early 1977 and a reasonable degree of improvement has been noted in subsequent scientific efforts, beginning as early as the *Bouchard 65* incident in January 1977.

The planning process has continued since early 1977 under the guidance of the National Response Team. Major planning and operational milestones achieved thus far are summarized below:

January, 1977 - Joint NOAA-EPA-USCG-State of Massachusetts scientific response to the *Bouchard 65* oil spill in Buzzards Bay. During this incident a joint operations center was established and scientific activities of all participants were integrated on daily basis.

February, 1977 - Joint NOAA-EPA-USCG scientific response to the *Ethel H.* oil spill in the Hudson River. All scientific activities were jointly planned and executed.

May, 1977 - First full-scale meeting of the NRT Task Force on Ecological Damage Assessment, involving all primary environmental agencies of the National Response Team as well as representative state agencies. During this session, general responsibilities of the various Federal agencies for scientific spill response were proposed, scientific problems were delineated and objectives of a proposed national response team were established.[2]

July, 1977 - Task Force report endorsed, with minor modifications, by agencies of the National Response Team. EPA and NOAA authorized to proceed with a workshop in Hartford, Connecticut to further define the response concept for the New England region.

August, 1977 - First regional workshop convened. Chaired by EPA, and attended by approximately 150 individuals representing Federal, state, academic and private interests, the workshop was instrumental in establishing a regional response structure for New England coastal waters as well as sharpening national response objectives and implementation mechanisms.[3]

August, 1977 - NOAA-US Navy-USCG response to an oil spill occurring in Baffin Bay, Greenland. The scientific team provided technical assistance in damage assessment and cleanup strategies.

October, 1977 - Major NOAA-Swedish response to a spill from the Soviet vessel *Tsesis* near Asko Island, Sweden. University scientists requested assistance of the U.S. team in damage assessment and provided extensive logistic and scientific support to the joint effort.

2. *Task Force on Ecological Damage Assessment, June 1977. Report to the National Response Team on Interagency Capability to Respond to Major Oil Spills.*

3. *Mitre Corporation, September 1977. Results of the Region I Workshop on Oil Spill Ecological Damage Assessment. Unpublished Manuscript.*

November, 1977 - Second regional workshop convened with concurrent sessions in Anchorage, Alaska and Seattle, Washington. Planning was initiated for the unique environmental problems which must be dealt with should a major spill occur in Alaskan waters. Chaired by NOAA, this workshop was attended by 180 individuals representating a broad range of environmental, socio-economic, and legal interests.

January, 1978 - Two NOAA Regional Scientific Support Coordinators appointed to focus scientific spill response and planning efforts in coastal areas of Alaska and the Gulf of Mexico.

January, 1978 - National Scientific Support Team concept implemented by Coast Guard directive as an integral part of Federal On-Scene Coordinator operations.

March, 1978 - Model Regional Environmental Response Plan completed for the New England region (Region I) and submitted to the New England Regional Response Team for approval.[4] The plan specifies organizational responsibilities among Federal agencies for environmental response, details of the activation mechanism, and scientific activities to be implemented under various spill conditions.

Although a great deal of progress has been made in the past several months to improve the spill response function within existing funding and personnel constraints, further efforts are necessary to complete implementation of the program. In the sections which follow we will recommend increases in the level of funding and personnel assigned to this effort as well as a number of other short-range actions which can be taken to improve management aspects of the program.

4. *Mitre Corporation, March, 1977. Region I Environmental Response Plan for Oil and Hazardous Substance Discharges in Coastal Waters. Unpublished Manuscript.*

## PROBLEM DEFINITION

Table 1 summarizes the incidence of oil spills over the past 3 years. The table indicates that although the number of spills has declined somewhat from a high in 1974, the volume of oil spilled, as well as the seriousness of major incidents, increased sharply in 1976.

In spite of improving technology in spill avoidance as well as improvements in the stringency of regulations with respect to tanker safety, the rate of spills is expected to increase from 1976 levels, with individual events continuing to become more serious on the whole. This expectation is based on an analysis of statistics associated with offshore exploration in frontier areas, transportation forecasts related to the Trans-Alaska Pipeline and Strategic Petroleum Reserve, and consideration of the increasing U.S. demands for imports of industrial chemicals and petroleum. Larger transport vessels, now becoming more prevalent, will account for the more serious spill events.

Whether or not this expectation is borne out, the probability of several potentially catastrophic spills occurring along the U.S. coast in the next few years is unquestionably quite high.

The central problem to be approached by this program is, therefore, one of achieving an adequate degree of preparedness to mitigate the consequences of these isolated events when they occur as well as dealing with the thousands of smaller events that cause serious, although more localized, impacts.

### Scientific Problems

The scientific issues which must be dealt with in mitigating and assessing the impact of contaminant spills are enormously complex, perhaps beyond the nation's scientific and technical capability to

Table 1. Incidence of Oil Spills in U.S. Navigable Waters Including Spills Beyond the Contiguous Zone Which Threatened the Contiguous Zone

| | Under 10,000 gal. | | 10-100,000 gal. | | 100,000-1,000,000 gal. | | >1,000,000 gal. | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Volume (gal.) | Number | Volume (gal.) | Number | Volume (gal.) | Number | Volume (gal.) | Number | Volume (gal.) |
| 1974 | 13,765 | 2.9 million | 169 | 1.7 million | 30 | 7.1 million | 2 | 2.3 million | 13,966 | 16.9 million |
| 1975 | 10,067 | 2.2 million | 94 | 2.5 million | 16 | 4.8 million | 4 | 5.0 million | 10,141 | 14.4 million |
| 1976 | 10,553 | 2.4 million | 90 | 2.4 million | 13 | 3.1 million | 4 | 16.2 million | 10,600 | 23.1 million |

approach definitively in the forseeable future. However, on the optimistic side, research in the area of hazardous substances, especially petroleum, is progressing at a rapid rate and information is now available which can be of considerable value to those charged with the mitigation of spill impact. Examples can be found in several areas, e.g., improvements in techniques for the rapid forecasting of spill movement, increasing knowledge of the conditions under which dispersants should and should not be used, better understanding of the location of critical coastal habitats requiring extraordinary protective efforts, etc.

In the realm of assessing the degree of environmental and socioeconomic impact, however, our present capability is relatively primitive. "State-of-the-art" assessments of the short-and long-term impact of petroleum hydrocarbons in the marine ecosystem have drawn considerable criticism from the scientific community and have, in general, left the public rather poorly informed as to the environmental consequences of offshore petroleum development and transportation. The following quotation from the May 23, 1977 issue of *Newsweek* clearly outlines the current dilemma:

> How much ecological damage does an oil spill really do? After the recent blow-out of the oil well Bravo 14 in the North Sea, there was a wave of warnings that marine life could be disrupted for years, but a review of three major spills in the past decade turns up surprisingly little evidence of any calamitous long-term effects in the environment.

*Newsweek* proceeds to examine assessments of the *Torrey Canyon, Argo Merchant*, and Santa Barbara oil spills concluding "that none of these incidents can be taken as definitive." Despite expenditures of several million dollars to conduct the assessments referred to, few scientists would argue with *Newsweek's* conclusion.

As indicated earlier, research in the area of effects of hazardous substances is progressing at a rapid rate; several Federal and state agencies now have significant programs underway and future increases are planned in some cases. Problems exist, however, in the application of much of this research to the very pragmatic scientific and economic questions that arise from a particular incident.

Pending spill liability legislation , discussed earlier, will require major improvements in our ability to interpret scientific findings in terms which are understandable and definitive in the legal arena. This issue has received considerable emphasis in our program planning to date, especially in regional workshops already held in New England and Alaska.

The solution to this problem appears to lie in:

1) Defining and implementing applied research efforts aimed at extending present research programs to actual conditions and pragmatic problems encountered in spill situations.
2) Developing the capability to assess the more indirect socio-economic losses which often accompany major spills.
3) Increasing interactions between the scientific and legal communities in advance of the implementation of new damage liability legislation.

## Institutional and Organizational Problems

The extent of governmental and academic interest in the scientific aspects of marine spills is difficult to visualize unless one visits the scene of a major spill. As indicated earlier, approximately 40 agencies and institutions, represented by 200 scientists, participated in one aspect or another of a complex series of *Argo Merchant* investigations.

Overlapping statutory and legislative authority in such cases tends to impede rather than strengthen the analysis and resolution of scientific questions which must be dealt with by the Federal On-Scene Coordinator. Two primary government agencies, NOAA and EPA, have statutory responsibility to provide assistance and assess environmental damage in the event of a spill, however, delineation of responsibility between these agencies has been unclear in the past.

Agreements between NOAA and EPA must be reached and further efforts undertaken to organize existing response capabilities of other Federal agencies. Close links should be established with BLM funded environmental assessment programs related to offshore development as well as with comparable NOAA programs in marine ecosystems analysis. Both "baseline" and process studies being undertaken by BLM and NOAA, as they reach full-scale implementation, will have major bearing on our ability to more quantitatively assess the impact of oil pollution incidents.

Action should be taken to more effectively incorporate state and academic efforts into the assessment process. The problems of nearshore impact are obviously of vital interest at the state and local level. It is also clear that the majority of the scientific talent required for scientific response resides outside the Federal establishment.

## II. GOALS AND OBJECTIVES

### OBJECTIVES

The overall purpose of this program is to provide timely and effective employment of scientific resources during spill emergency situations. The major objectives of the program are:

1) To provide the National Response Team, Regional Response Teams and On-Scene Coordinators with highly-qualified scientific assistance in mitigating the environmental and socio-economic impacts of spills of oil and other hazardous substances.

2) To provide scientific assistance to the Environmental Protection Agency in assessing the damage resulting from such spills.

3) To maximize the research advantage offered by the spill situation, especially with respect to improving future response capabilities.

In a spill emergency situation, these objectives will be approached in the order of precedence indicated.

## Mitigation of Spill Impact

Requirements for scientific coordination and assistance under this objective may be categorized as follows:

1) Support in trajectory modeling, i.e., prediction of the movement of a contaminant in a given period, time and location of landfall, etc.
2) Advice on other aspects of the behavior and fate of contaminants, e.g., the alteration in physical characteristics which can be expected of a given contaminant under a variety of environmental conditions; the prospects of water column mixing, sinking; etc.
3) Advice on the likely environmental impact of various alternative cleanup strategies, e.g., advice on the use of dispersants.
4) Measures to be used in dealing with the oiling of marine birds and mammals.
5) Identification of critical habitats requiring extraordinary protective efforts.
6) Advice on dealing with hazardous materials under unusual environmental conditions, e.g., sea ice, severe storms, etc.
7) Assistance in organizing and coordinating scientific efforts by the academic community.
8) Assistance in public relations efforts with respect to scientific issues.

## Assessment of Damage

For the purposes of this plan, damage to natural resources is considered to include 1) immediate or long-term injury, alteration, or destruction of naturally occurring organisms, populations, communities, habitats or functional properties of ecological systems, and 2) associated impacts on aesthetic, recreational, commercial or other benefits derived from these resources. The ultimate aim of this objective is to provide sound scientific information, analysis and opinion that can be used in litigation or administrative proceedings. The emphasis on litigation is indeed important and will have major bearing on both the conduct and scope of activity carried out under this objective.

Operationally, environmental damage assessment activity will involve four major components:

1) On-scene surveys of acute and other directly measurable impacts on natural resources;
2) Other scientific studies, including laboratory investigations to establish the more subtle, sub-lethal environmental effects of the incident;
3) Surveys of potential socio-economic losses; and
4) Interpretation and analysis of the findings above to provide information to be used in legal or administrative proceedings.

## Spill Research

It is clear from our discussion earlier that impact mitigation and assessment activities can be better organized and that the "state-of-the art" can be improved with a greater degree of planning and coordination. However, these steps are, in themselves, insufficient.

This objective has the primary purpose of promoting and coordinating research activities that will enhance the general understanding of pollution discharges in marine, estuarine and coastal environments. Research included under this objective includes field studies, laboratory studies, baseline studies and socio-economic analyses. The specific intent of this objective is to:

1) Assist in the direction of national research efforts toward the goal of improving damage mitigation and assessment capabilities;
2) Provide a mechanism for timely notification of research opportunities; and
3) Coordinate research activities in the spill area to prevent unnecessary duplication and minimize interference with operational activities.

BENEFITS

## Environmental Protection

The major thrust of this program is the mitigation of environmental impacts caused by pollutant spills through better utilization of existing scientific resources. The organizational system being established will increase the Federal government's ability to respond through improved coordination and planning of the scientific response effort. The system provides for on-site scientific expertise to be available to the OSC. Such advice can be critical in the protection of the environment when decisions are made concerning the deployment of booms, the strategy and method of cleanup actions, the type of dispersant to employ, the timing of other operational activities (e.g. destruction of the *Argo Merchant* bow), etc. The system will remove the burden of coordination of scientific activities from the OSC so that more of his efforts can be directed toward cleanup and containment of the spill and other measures to mitigate impact.

The scientific response plan, while shifting coordination of scientific activities from the OSC, does provide for the conduct of research, if such studies will not interfere with the OSC's operational activities. It is well understood by the proponents of this response mechanism that knowledge gained through in situ studies of the behavior and effect of a pollutant, will increase scientists' ability to provide better advice to the OSC and thus improve chances of mitigating environmental impact. Consequently, the scientific response plan not only provides for a mechanism that facilitates research, but also includes plans for the types of studies that can and need to be done, thus optimizing the research opportunity afforded by spills.

## Assessment of Damage

New and pending legislation requires that the Government take action to insure that a proper penalty is assessed against the polluter for damage to the environment and its resources (oil pollution liability legislation) and that the impacted natural resources are restored or rehabilitated (Clean Water Act Amendments of 1977). In order to assess appropriate funds, it is necessary that the scientists become actively involved in determining the extent of damage and the measures to be taken to restore the injured resources or accelerate recovery. Through the scientific response plan, the assessment of damage related to the polluting incident will be blended into other scientific studies, optimizing the resources being applied to the problem as well as taking advantage of all related information being collected. The plan will thus 1) provide for appropriately experienced scientists to evaluate any damage resulting from the polluting incident, 2) minimize costs through coordination of all scientific activities, and 3) help establish the degree of damage in monetary terms.

## Support To Other Programs

The system being established facilitates the conduct of scientific studies designed to increase the general understanding of pollutants. Studies addressed toward specific areas where knowledge is lacking or weak are to be blended into the general scientific response plan. Theories or hypotheses being used in other programs can be validated or disproved through testing in a "real-life situation." Data from these "tests" can result in program redirection and a consequent savings in time and resources that might otherwise have been spent futilely.

The information collected through support of the OSC and in the conduct of damage assessments will also be made available to the managers of pollution related projects. NOAA alone conducts over 140 projects, with an annual expenditure of $14.5 million, which could potentially benefit from data collected from a spill incident. The scientific response plan includes ways whereby information can be easily exchanged between this and related programs so that maximum use can be made of collected data.

## III. IMPLEMENTATION STRATEGY

The overall implementation strategy for interagency aspects of this program was established initially by the NRT Working Group on Ecological Damage Assessment in April, 1977. Six major elements are involved in this strategy:

1) Development of a national focal point for overall planning, preparedness and review functions (National Scientific Support Team);

2) Implementation of an operational response structure at the regional level (Regional Scientific Support Teams);

3) Extensive planning for scientific and operational aspects of the spill response effort;

4) Formal revision of agency responsibilities relative to scientific spill response;

5) Adequate training of response personnel; and

6) Identification of funding sources.

## NATIONAL SCIENTIFIC SUPPORT TEAM

A National Scientific Support Team will provide guidance to the regional response organizations; carry out national planning, preparedness and review functions; and provide on-scene support when necessary (Fig. 1). The team will be comprised of Federal experts in various scientific and technical aspects of pollution discharge response.

The specific responsibilities of the National Scientific Support Team are to:

1) Identify national scientific priorities and review scientific aspects of regional plans for technical quality, uniformity of techniques, and duplication.

2) Monitor scientific response activities carried out under regional plans.

3) Coordinate and deploy national scientific and logistic resources which may be required to assure an adequate scientific response to major spills.

4) Evaluate the effectiveness of scientific response activities and recommend appropriate modifications to regional plans.

5) Provide scientific advice to the National Response Team and assist the NRT in ensuring that Regional Contingency Plans include an effective environmental response capability.

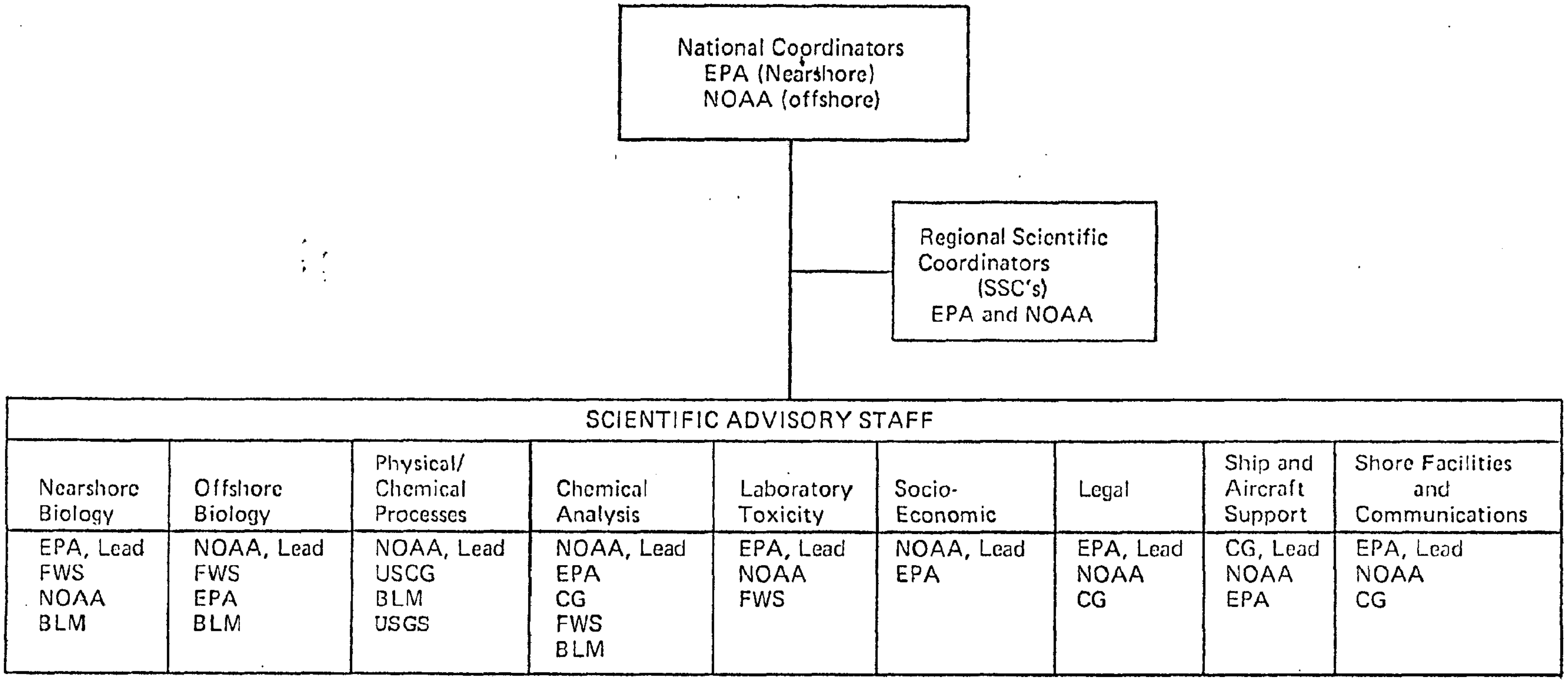


FIGURE 1. ORGANIZATION OF NATIONAL SCIENTIFIC SUPPORT TEAM FOR COASTAL AND MARINE SPILLS

## REGIONAL SCIENTIFIC SUPPORT TEAMS

Regional teams will be assembled with an organizational structure and functional responsibilities roughly paralleling the national organization discussed earlier (Fig. 2).

These Regional Scientific Support Teams and associated Science Support Coordinators comprise the primary operational element of the program with the specific responsibility of working with the regional scientific community and member agencies of the Regional Response Team to:

1) Develop detailed scientific plans for response to a variety of spill scenarios;

2) Identify and ensure the availability of scientific and other resources necessary to implement damage assessment activities as may be required by EPA; and

3) Coordinate all scientific activity during the spill incident.

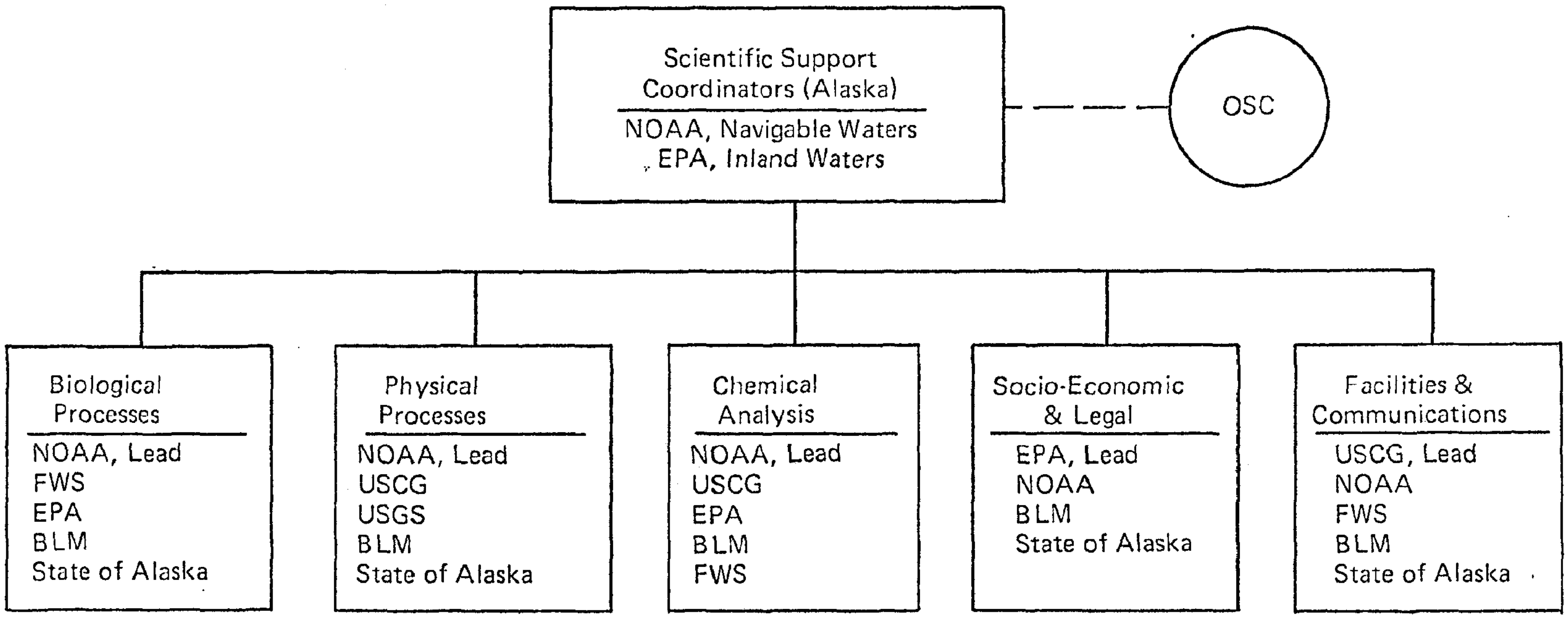


FIGURE 2. REGIONAL SCIENTIFIC SUPPORT TEAM STRUCTURE FOR ALASKA

## SCIENTIFIC AND OPERATIONAL PLANNING

### Regional Planning Workshop

Comprehensive planning of the scientific response function must consider a combination of national and regional priorities as well as scientific resources. A series of regional planning workshops has thus been organized to develop the scientific program to be implemented during and following spill incidents. Two such workshops have been held thus far: in Hartford, Connecticut in August, 1977; and in Anchorage, Alaska in November, 1977. Others are planned for the Gulf of Mexico, Mid-Atlantic, Southeast Atlantic, Great Lakes and West Coast. Each workshop has and will continue to build on the results of those which preceeded. New concepts which evolve will be included in plans resulting from the intital workshops.

### Development of Notification And Activation Mechanisms

Past experience has indicated that development of an effective notification and activation mechanism will be a key element in the implementation strategy for this program. For obvious reasons, essential personnel or suitable alternates must be available around the clock to respond to spill emergencies. Equally important is the development of a clear channel for authorization and funding of scientific activity during the spill incident.

The Regional Scientific Support Coordinator is the focal point of the notification system, maintaining contact at all times with the Regional Response Center and an information relay center maintained by the National Scientific Support Team in Boulder, Colorado (Fig. 3).

It is important to point out that all scientific activity under taken under this plan -- with the exception of that funded from sources

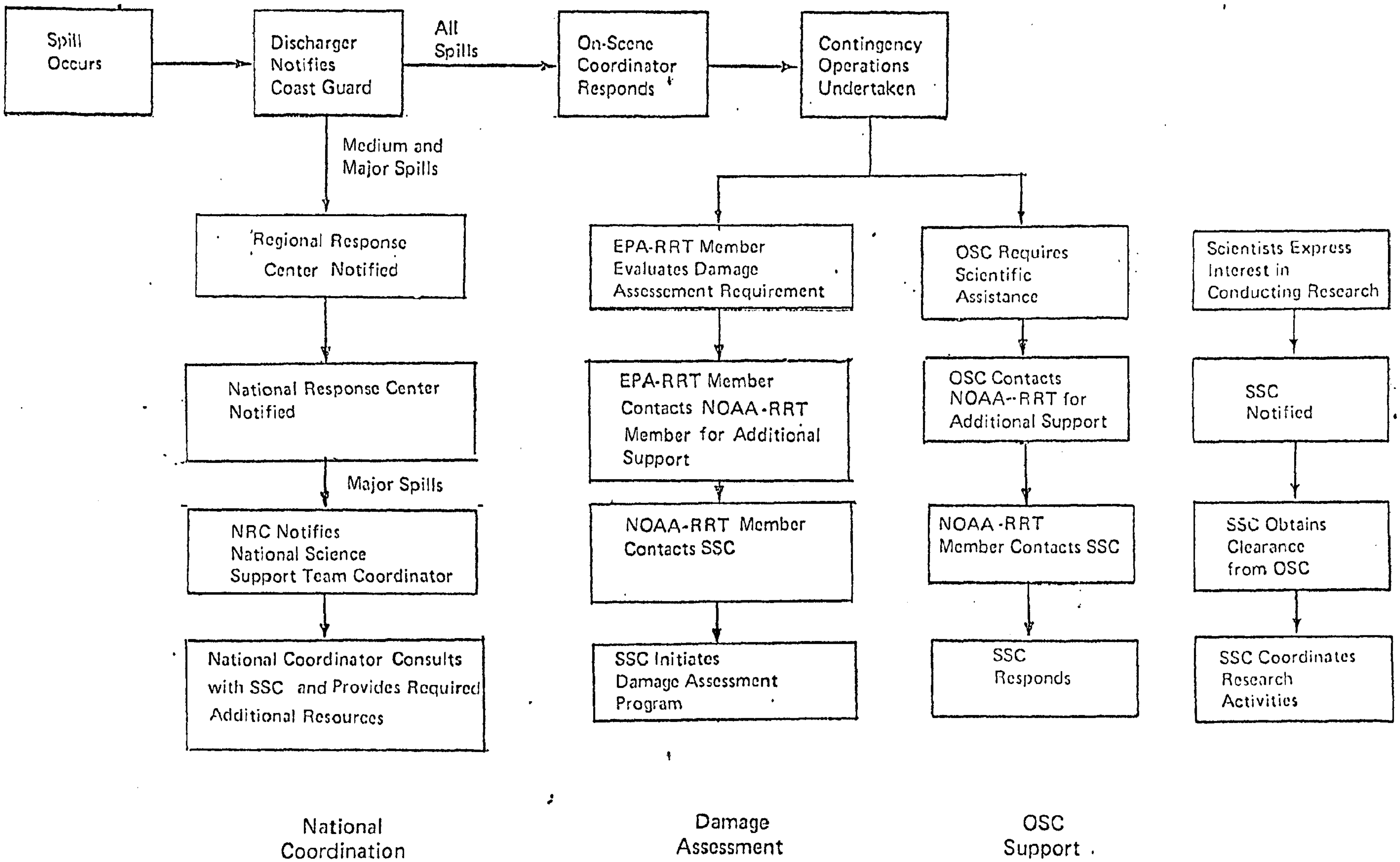


FIGURE 3. NOTIFICATION AND ACTIVATION PROCEDURES

outside this program -- must be specifically requested by the Federal On-Scene Coordinator or representatives of the Environmental Protection Agency and authorized by the NOAA or EPA member of the Regional Response Team. Major commitments of resources must be authorized by the NOAA Associate Administrator.

MODIFICATION OF AGENCY RESPONSIBILITIES UNDER THE NATIONAL CONTINGENCY PLAN

As indicated earlier, the National Contingency Plan is the principal Federal mechanism for operations undertaken in response to pollutant discharges occurring in navigable waters, adjoining shorelines and high seas of the United States. Operational details of the response effort are specificed in Regional Response Plans.

In order to establish a formalized basis for the response structure proposed in this plan, certain modifications to the National Contingency Plan will be required. These modifications relate primarily to the responsibilities assigned to EPA and NOAA in the Plan. Appropriate revisions are now being drafted for submission to the Council on Environmental Quality.

TRAINING

One of the major efforts that will be made when the project is fully implemented is the training of numerous scientists from Federal and state governments, the private sector, and adademia since the effectiveness of a response is due in great part to the experience of the team members and the rapidity with which they can respond. Training a large number of individuals within the region provides a greater resource on which to draw both in terms of capabilities and redundance. Individuals participating in several spills during a short time interval have difficulty maintaining continuity in other non-spill related programs.

## FUNDING SOURCES

Funding for response operations has been identified as follows:

OSC Assistance - Scientific response operations undertaken at the direct request of the On-Scene Coordinator or his authorized representiative will be reimbursed through the National Contingency Plan "Pollution Fund", if other conditions regarding use of the fund have been met.

Damage Assessment - It is anticipated that activity undertaken at the request of the Environmental Protection Agency for purpose of damage assessment will be reimbursed by the Pollution Fund or through provisions of pending liability legislation.

Research - Research activities undertaken during the spill incident which fall outside either the above categories are to be funded by the agency or institution sponsoring the research.

Other Program Activities - Activities of the following nature will require separate agency funding:

1) Planning, management and administration.

2) Scientific and developmental activity undertaken in preparation for the spill incident, e.g., training of response personnel, preparation of computer programs, identification of critical habitats.

3) Response activity undertaken in support of the OSC oversight function in those instances in which other conditions regarding use of the Pollution Fund have not been met, e.g., instances in which a pollution discharge is averted, instances in which the Federal government does not intervene in clean-up and containment operations, etc.

4) Capital equipment necessary to support response operations.

5) Salaries of Federal employees participating in this program.

Funding considerations will be discussed further in Chapter V.

## IV. NOAA MANAGEMENT PLAN

### INTRODUCTION

The management system being established within NOAA to support the interagency scientific support program was designed around three key factors essential to an adequate response:

1) Flexibility for rapid response;

2) Ability to bridge organizational lines at a middle management level;

3) Close dovetailing of the NOAA program with other interagency efforts.

To address these elements an abbreviated organizational structure will be implemented during a spill situation. This structure has shortened communication lines and chains of command and increased authorities for key personnel to enable a rapid response across normal organizational divisions. Meshing of the NOAA program with the larger interagency program is insured by having the Manager of the Hazardous Materials Response Project Office function as the NRT's National Scientific Support Coordinator for marine spills. Further program integration is insured by assignment of lead NOAA responsibility on the NRT to the

Office of the Assistant Administrator for Research and Development, with the National Coordinator as alternate. Following is a more detailed description of the roles and responsibilities of the various NOAA elements under spill and non-spill conditions.

ORGANIZATION AND MANAGEMENT DURING NON-SPILL SITUATIONS

Organizational Structure, Roles and Responsibilities

The focal point of NOAA's response to pollutant spills is the Hazardous Materials Response Project Office located in Boulder, Colorado. This office is responsible for developing the framework within which NOAA response will function and implementing that response, as necessary. Additionally, this office and R&D Headquarters are responsible for organizing the Federal scientific response to marine pollutant spills. The Project Office is located in the Marine EcoSystems Analysis (MESA) Program Office which is part of the Environmental Research Laboratories (Fig. 4).

Project Responsibilities - The *Project Office* is responsible for:

1) Determining, developing and disseminating guidelines for project implementation;

2) Establishing and ensuring that the framework and plans exist for a coordinated, effective, and timely scientific response to marine pollutant spills;

3) Evaluating spill responses and initiating corrections or project re-direction, as appropriate; and

4) Integrating NOAA regional plans into a composite NOAA plan.

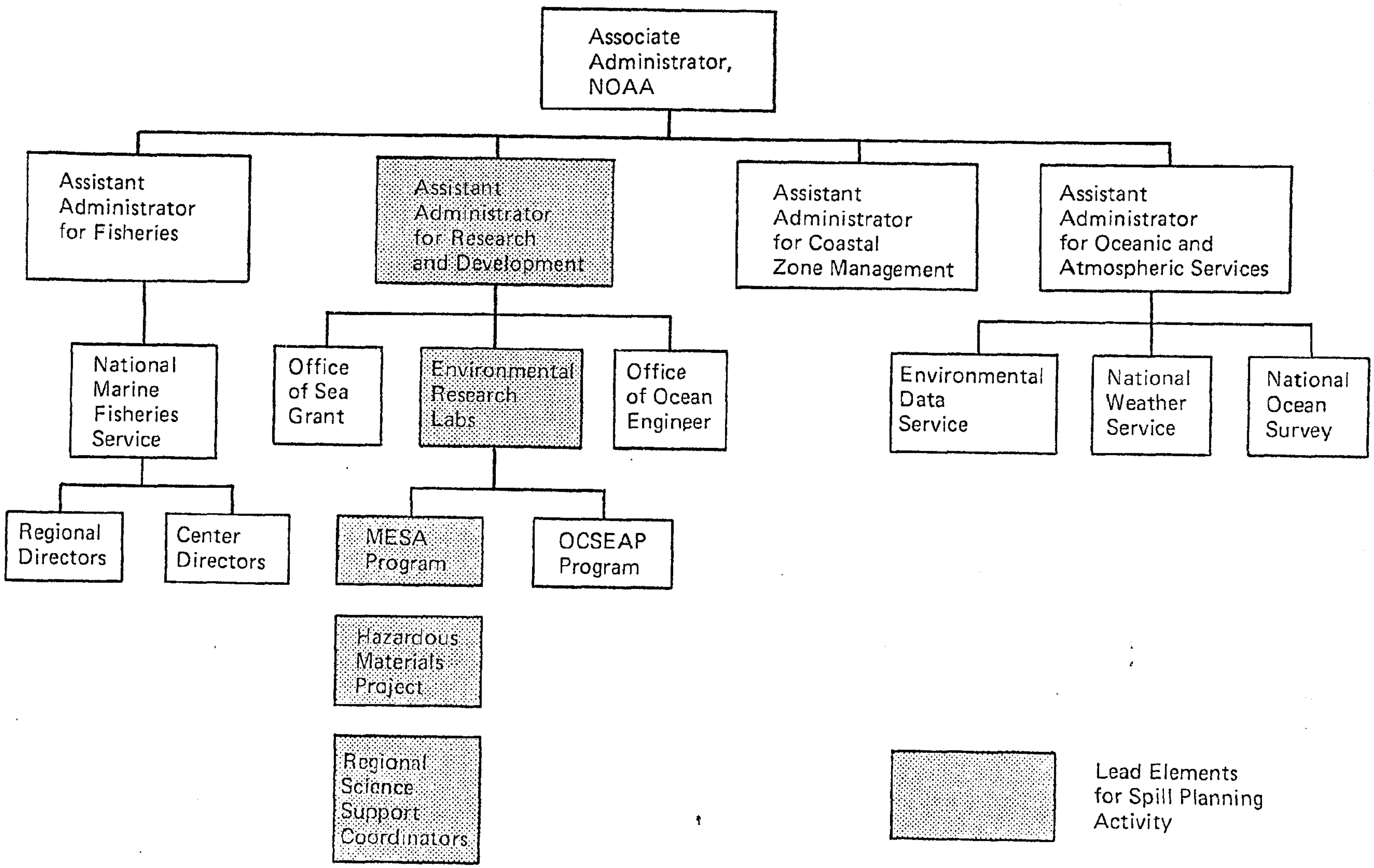


FIGURE 4. ORGANIZATION OF SPILL-RELATED ELEMENTS DURING NON-SPILL PERIODS

The *Project Manager* is responsible for ensuring that these tasks are carried out as well as the following:

1) Defining project organization, lines of communications, and project personnel responsibilities;

2) Developing interagency agreements and inter-MLC guidance regarding spill responses;

3) Preparing and presenting briefings to Federal, State and public groups on the Federal spill response program;

4) Assigning tasks to project personnel and insuring their timely completion;

5) Serving as the NOAA alternate on the National Response Team;

6) Representing NOAA on interagency committees concerned with pollutant spills; and

7) Establishing, in conjunction with appropriate supervision, a system that rapidly obtains response personnel clearances.

In addition to the Project Manager, there will be three other full time personnel making up the Project Office staff: a marine scientist who has a broad overview of the quality, effectiveness and planning of the scientific program; a logistics specialist who is responsible for personnel training, logistics and equipment and other on-scene support; and a secretary.

*Scientific Support Coordinators.* The Project Office is supported by five scientists located in the field, one near each coast: Atlantic, Gulf of Mexico, Pacific, Alaska and Great Lakes. The regional Scientific Support Coordinators (SSC), have duties as follows:

1) Developing and updating Regional Environmental Response Plans.

2) Establishing an information exchange program among scientific representatives of Federal, state and academic institutions involved in spill response activities.

3) Obtaining prior contractual agreements with potential response personnel and sources of logistic support.

4) Obtaining equipment and supplies necessary for an effective response.

5) Conducting preparatory scientific studies, e.g. identification of critical habitats, analysis of likely pollutant trajectories, etc.

MLC Support - Support from other NOAA MLC's is required for the proper implementation of this project.

*Office of the Assistant Administrator for Fisheries*

1) Identification of important fishing, spawning and nursery areas;

2) Coordination with the fishing industry;

3) Recommendation and advice on studies to evaluate impact on living marine resources;

4) Identification of threatened or endangered species and their behavior patterns;

5) Assistance to the Scientific Support Coordinator in preparing and implementing regional plans;

6) NOAA representation on Regional Response Teams, and;

7) Information on living marine resources and their environment.

*Office of the Assistant Administrator for Oceanic and Atmospheric Services*

1) Data storage, cataloging, and retrieval (EDS);

2) Information on current and predicted meterological and hydrologic conditions (NWS);

3) Development of a pollutant trajectory forecast system (NWS);

4) Chain of custody guidance (EDS); and

5) NOAA representation at inland RRT meetings (NWS).

*Office of the Assistant Administrator for Coastal Zone Management*

1) Assistance in the identification of coastal areas as critical or sensitive;

2) Guidelines for assessing socio-economic impact;

3) Data on the marine industry infrastructures.

*Other Elements of the Office of the Assistant Administrator for Research and Development*

a) Field Offices

   1) Quick access to university services and expertise (OSG);

   2) Marine environmental data on pollutant effects and behavior (ERL); and

   3) Research on trajectory modelling (ERL).

b) R and D Headquarters

   1) Policy guidance and oversight of the scientific response to major oil spills;

   2) Execution of interagency and MLC agreements;

   3) International program coordination;

   4) Establishment of the framework for program coordination with other MLC's and Federal agencies;

   5) NOAA representation on the National Response Team and the establishment of NOAA policy on matters relating to the NRT and NCP; and

   6) Review and evaluation of spill responses in terms of effect on NOAA resources and programs and the effectiveness of spill responses in terms of NOAA's responsibilities.

ORGANIZATION AND MANAGEMENT OF SPILL-RELATED EFFORTS

## Organization

During a non-spill situation, project personnel follow normal communication channels and lines of authority required of any project within NOAA. However, during a spill, communication lines are shortened and authorities increased to expedite the response. The organizational system must thus be flexible enough to provide for quick responses, yet be adequately structured to maintain major organizational relationships. Figure 5 indicates the organizational structure that will be implemented in the event of a spill incident.

## Roles and Responsibilities

*The Office of the Assistant Administrator for Research and Development* has the following responsibilities during a spill situation:

1) Represent NOAA on the National Response Team;

2) Function as an information clearinghouse for all NOAA elements and other NRT members, including initial notification of a spill or potential spill, when approriate;

3) Participate in policy decisions on issues surrounding the incident;

4) Obtain support from other MLC's or agencies, when needed; and

5) Evaluate the response and insure that appropriate corrective actions are taken when needed.

The responsibilities of the *Manager, Hazardous Materials Response Project (National Scientific Support Team Coordinator)* during a spill are to:

1) Assist the Regional Science Support Coordinator in organizing the overall NOAA and Federal scientific effort during major spills;

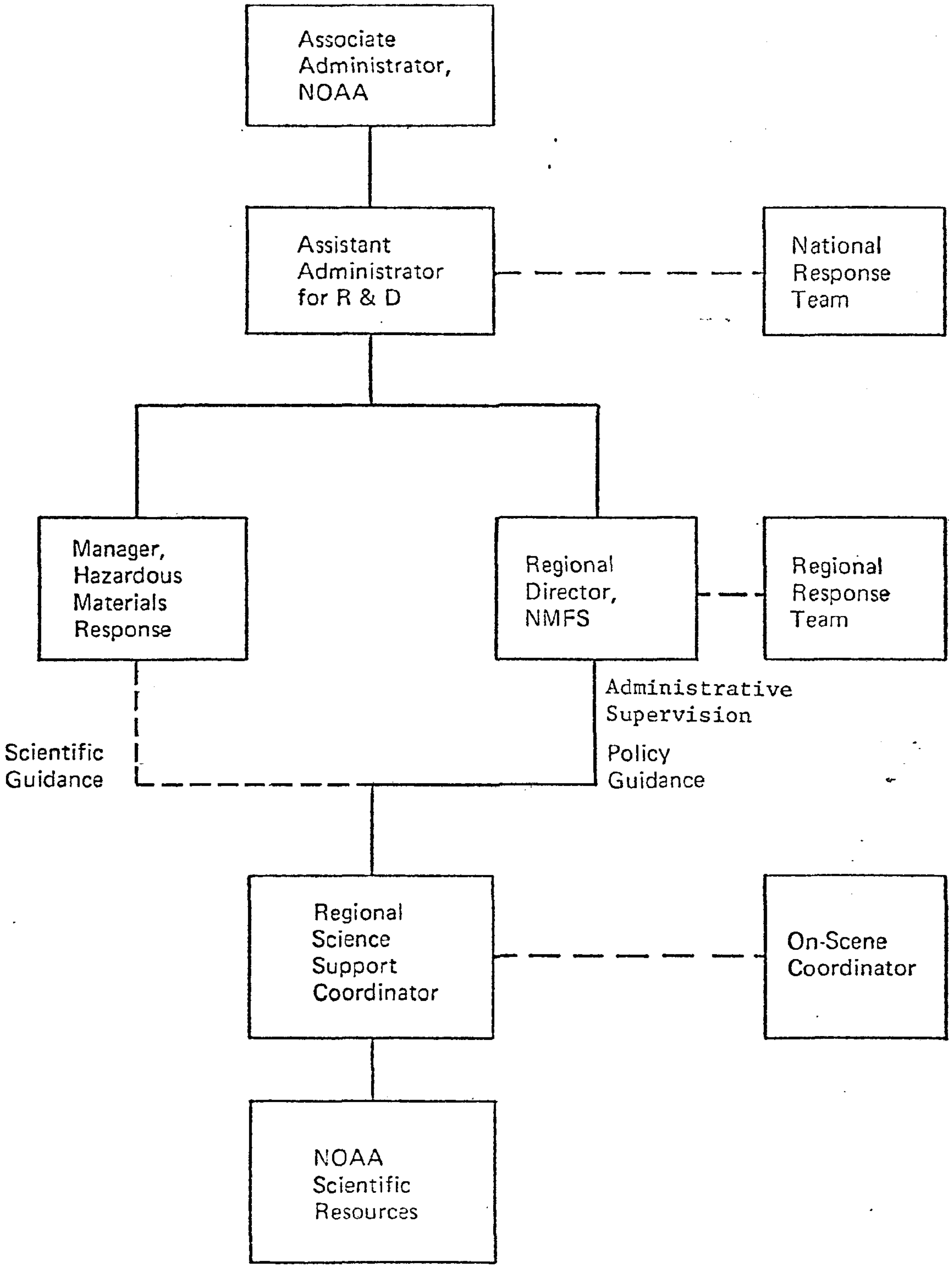


FIGURE 5. NOAA SPILL RESPONSE STRUCTURE

2) Evaluate and recommend to the Assistant Administrator for R&D the level of commitment of NOAA resources to a major spill response;

3) Evaluate the spill in terms of its research potential and advise the appropriate NOAA elements when the opportunity for research exists;

4) Provide scientific advice and obtain logistics, equipment, and other support from NOAA and other Federal Agencies as required by the Regional SSC;

5) Serve as the Regional SSC in his absence or assist the the Regional SSC on scene when necessary;

6) Evaluate the response following its completion and recommend corrective actions, where appropriate; and

7) Ensure that adequate documentation is performed during a response especially in those areas concerning interagency commitments.

During a spill situation, the *Regional Director of NMFS* is the regional spokesman for NOAA. It is the responsibility of the Regional Director to:

1) Represent NOAA on the Regional Response Team;

2) Provide administrative supervision and policy guidance to the Regional Science Support Coordinator;

3) Advise the Scientific Support Coordinator on sensitive environmental issues;

4) Function as the NOAA focal point for interactions with the public and the press; and

5) Advise NOAA Headquarters on the handling of important issues surrounding the polluting incident.

During a spill situation, the responsibilities of the *Regional Scientific Support Coordinator* are to:

1) Coordinate the scientific activities of all Federal, state and academic participants in the spill response;

2) Serve as the primary contact point between the OSC and responding experts;

3) Advise the On-Scene Coordinator on the scientific aspects of the spill mitigation effort;

4) Organize and implement the damage assessment effort as requested by the Environmental Protection Agency and

5) Serve as the alternate to the NMFS Regional Director on the Regional Response Team;

6) Apprise the NMFS Regional Director on all major actions and consult with him on sensitive environmental issues.

Support to be provided by *other NOAA Major Program Elements* during a spill - beyond providing response personnel - includes:

1) Ship support (NOS);

2) Equipment and facilities (NMFS, NWS, ERL, OOE);

3) Weather forecasts and other meteorological information (NWS);

4) Trajectory forecasts (NWS, ERL);

5) Satellite spill tracking and megascale oceanographic features (NESS, NWS);

6) Chain of custody guidance (EDS); and

7) Expertise on fisheries and the fishing industry (NMFS).

<u>Activation</u>

Notification of a spill or potential major spill may enter the NOAA system at several points, the most likely being the Regional Director/NMFS, a regional office of the NWS (WSFO), the Regional SSC, or through the 24 hour information clearinghouse in Boulder. Regardless of the channel through which the initial notification occurred, a line of communication must be immediately established between the On-Scene Coordinator and Regional Director of NMFS to determine whether NOAA scientific support services may be required.

The NMFS Regional Director is responsible for notifying other NOAA regional offices, as well as the Office of the Assistant Administrator for Research and Development. The latter is responsibile for informing the remaining MLC Directors, as appropriate, and the Associate Administrator, if the situation warrants.

The National Coordinator, the Regional Director of NMFS and the Regional SSC will evaluate the situation and agree upon a general plan of action. A minimal team effort may be employed initially to provide immediate assistance to the OSC, to study short lived phenomenon, and plan further response activities which may be necessary. If the recommendation is made that a larger effort is required by NOAA, the National Coordinator, the Office of the Assistant Administrator for Research and Development, and the appropriate MLC Directors will confer with the Associate Administrator of NOAA to determine the extent of resources to be applied. Consultation with officials in other Federal agencies will also be conducted prior to a final decision.

On approval from the Associate Administrator on the general level of response, the Regional Director/NMFS and the Regional SSC will mobilize regional resources. If these resources are not sufficient, the National Coordinator will mobilize additional resources and personnel from outside the region, in conjunction with the multi-agency response.

POST SPILL ACTIVITIES

Following each major NOAA response, the Office of the Assistant Administrator for Research and Development and the National Coordinator will conduct an evaluation of the response, both in terms of NOAA's internal functioning and in the context of the interagency response. For those areas where deficiencies or weaknesses are identified, the Assistant Administrator for Research and Development is responsible for insuring that appropriate corrective action is taken.

## V. TECHNICAL DEVELOPMENT PLAN

### INTRODUCTION

The purpose of this section is to outline the approach the project will use in technical planning and provide details on funding and manpower requirements. To provide a context for this discussion a brief response scenario is appropriate.

Of major importance in any spill response is the timing of notification and activation of response forces. Acute environmental impacts will be most severe during the early stages of the incident, thus mitigation efforts must be most concentrated at the outset. This fact argues strongly for before-the-fact development of plans, contractual and logistic arrangements, equipment pools, etc.

More often than not initial details on a pollution incident are sketchy, and the first order of business is usually one of assembling information which is critical in determining the nature and scope of the response -- what is the potential magnitude of the spill, the nature of the pollutant, the prognosis for containment, etc. In a major spill situation, the Science Support Coordinator will report to the scene of the incident to provide whatever immediate assistance may be required and to gather information necessary to determine the scope of the eventual response likely to be required. If the spill has potentially serious consequences, response team functional leaders would be alerted and necessary administrative clearances would be obtained.

The first priority of the response team is one of assisting the Federal On-Scene Coordinator in his efforts to contain the spill or otherwise mitigate its effects. From a scientific standpoint, this support effort usually involves pollutant trajectory forecasts, analysis of the toxic potential of the pollutant, estimates of the likely rate of change in physical and chemical properties, etc. This effort may also involve evaluation of various clean-up strategies from an environmental standpoint, providing advice on the handling of oiled birds and marine mammals, etc. A key point in the implementation strategy in this area is the accessibility of a prearranged network of outside experts and facilities which can be called on to assist in dealing with extraordinary circumstances.

In a major spill situation, damage assessment activities will also be initiated along a pre-arranged plan. These activities will first include analysis of the area in which impacts are expected based on an understanding of the location and concentration of the pollutant as well as its expected toxicity over time. Laboratory studies may be required if the toxic potential of the pollutant is unknown with respect to the affected ecological system. Field sampling efforts will be initiated where possible to corroborate the more theoretical estimate of damage derived from the evaluation above. Long-term sampling efforts may be necessary to document eventual recovery of the system as well as chronic or sub-lethal impacts.

During the spill incident, the Scientific Support Coordinator will also be required to support the efforts of those having a research interest in the spill situation. The natural laboratory setting of a major spill event may be anticipated to attract a number of scientists who will require a variety of logistic, equipment and other technical support arrangements. The Coordinator's responsibility here is to accomodate all reasonable requests for assistance consistent with operational and safety considerations, making judgements among projects where necessary based on a general knowledge of regional and national research priorities.

## TECHNICAL PLANNING AND PROGRAM IMPLEMENTATION

### Planning for the Response Effort

As indicated in earlier sections of this document, technical planning of the response effort begins with regional workshops undertaken to define technical issues, identify potential response personnel and scientific tasks to be undertaken. Based on the recommendations received during these workshops, tasks are assembled into packages that address the objectives of the scientific support concept; support to the OSC, damage assessment, and research to improve basic knowledge of pollutant behavior and effects. In consultation with the USCG and EPA, priority tasks are identified in order to adequately meet operation requirements. Additionally, tasks will be grouped by circumstances in which they will be utilized (e.g. type of pollutant, environmental conditions, location, etc.).

Both the National and Regional Scientific Support Teams will continue to build on the planning framework provided by the workshop, constructing several response scenarios. These scenarios will consider a variety of pollutants as they may be expected to interact with the environment in a range of geographical locations, weather conditions, etc. The specific scenarios chosen for examination will be based on the likelihood of the specific event occurring as well as on an analysis of shipping statistics, areas of active development, weather patterns, etc.

For each scenario, the technical plan will provide explicit detail on the sequencing of tasks selected to be implemented, the identification of response team personnel, logistics considerations, and costs.

The plan will consider on-going programs of Federal, state and academic institutions and the extent to which incorporation or augmentation of such programs may be necessary to the spill response.

Pre-Spill Preparation

The focal point of the project's preparedness activity is the Regional Science Support Coordinator. During non-response periods he continues to sharpen the overall plan to improve the quality of future response activities.

Considerable information can be provided the OSC prior to a spill to help in the development of contingency plans. Information that can be provided includes 1) the probability of spills originating from selected sites impacting specific areas or critical environments, 2) the location of environmentally sensitive regions, 3) background information on the behavior of the various pollutants under a range of environmental conditions, and 4) information on the likely environmental impact of various alternative clean-up strategies.

Information is also needed prior to a spill for the purpose of damage assessment. Data needed includes not only environmental information but also socio-economic "baselines." Assessing damage following a spill and relating it directly to the pollutant as the cause is extremely difficult; moreover, it is more difficult if there is no information on conditions prior to the incident against which a change can be determined. Thus, efforts will be made to collect, organize and evaluate existing information on the environmental and socio-economic characteristics of a region. Critical information gaps will be identified and where funds allow, studies initiated to address these areas.

At a minimum, the following elements should be in place prior to a major spill event:

1) A regional environmental response plan, specifying details of the management structure for the response.

2) Prior contractual arrangements with potential response personnel and sources of logistic support.

3) Pre-designation of critical habitats or other environmentally sensitive regions requiring extraordinary protective efforts.

4) Analysis of likely pollutant trajectories based on climatological information.

5) A trained core response organization whose members are current in the "state-of-the-art" in mitigation, damage assessment and operational functions.

6) Development of sufficient equipment and supplies with which to undertake an effective response.

## Support Studies

There is a definite need for longer term studies of contaminant behavior or effects which are not directly related to a specific spill. These studies are necessary to provide a better perspective against which to assess damage or advise the OSC in ways to mitigate damage. The effort toward these studies under this project will be mostly in the identification of problems that need to be addressed and the recommendation to appropriate agencies or other NOAA elements that this work be conducted.

## Schedule

Tables 2 and 3 indicate the implementation schedule for scientific support team operations.

Table 2. National Implementation Milestones

| | 1977 | | | | | | 1978 | | | | | | | | | | | | 1979 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A |
| Project Office Established | X | | | | | | | | | | | | | | | | | | | | | |
| National Contingency Plan Modified | | | | | | | | | | X | | | | | | | | | | | | |
| MOU's reached with other Federal & State agencies | | | | | | | | | | | | X | | | | | | | | | | |
| National Guidelines provided for OSC support | | | | | | | | | | | | | | X | | | | | | | | |
| National Research Priorities Defined | | | | | | | | | | | | | | | | X | | | | | | |
| National Guidelines Provided for Damage Assessment | | | | | | | | | | | | | | | | | | | | | | X |

Table 3. Regional Implementation Milestones

| | 1977 | | | | | | 1978 | | | | | | | | | | | | 1979 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O |
| Northeast | | A | | | | | | C | | | B | | | D | | E | F | | | | | | | | | | | |
| Alaska | | | | | A | | | B | C | | D | | E | F | | | | | | | | | | | | | | |
| Gulf Coast | | | | | | | | B | | A | C | | D | | E | F | | | | | | | | | | | | |
| Mid-Atlantic | | | | | | | | | | | B | | A | C | | D | | E | F | | | | | | | | | |
| South-Atlantic | | | | | | | | | | | B | | | | | A | C | | D | | E | F | | | | | | |
| West Coast | | | | | | | | | | | | | | B | | | | | A | C | | D | | E | F | | | |
| Great Lakes | | | | | | | | | | | | | | | | | B | | | | | A | C | | D | | E | F |

A Workshop Convened
B Scientific Support Coordinator Appointed
C Regional Environmental Response Plan Completed
D Technical "Spill Scenarios" Completed
E Training Completed
F Initial Preparatory Actions Taken/Full Response Capability Achieved

## A PROTOTYPE PLAN

In the New England region, technical planning has proceeded through two phases -- identification of possible response tasks and an initial evaluation of the contribution each task may make to the overall response effort.

Table 4 summarizes the full range of possible response tasks proposed by the New England scientific community, providing information on conditions under which the task is applicable, equipment and logistics needs, costs, limitations, etc.

Tables 5, 6 and 7 represent an initial assessment of the material provided. These tables were developed to subdivide the proposed effort into the following categories:

1) Primary Program - Table 5 indicates tasks that might be expected to produce information of immediate value in enhancing relatively short-term impact mitigation and assessment capabilities. It comprises a "no-frills" program that might be conducted in response to a typical medium or major spill in the New England region.

2) Spill Dependent Program - Table 6 indicates tasks which are conducted in conjunction with a spill, but have lower potential for immediate applicability to impact mitigation or assessment activities than those listed under the primary program. These tasks are significant in terms of developing longer range predictive tools and in improving environmental damage assessment capabilities in the intermediate and long-term.

3) Spill Independent Program - Table 7 identifies tasks which can be conducted independent of a pollutant spill (e.g. experimental and theoretical efforts). These tasks tend to have applicability to all regions, supplying background information which, in the future, would be helpful in impact assessment efforts.

The next step in the New England planning effort, as indicated earlier, will be to specifically align these tasks around several response scenarios, adjusting the level of effort required depending on the nature of the hypothesized spill. A decision tree for each scenario will then be developed, establishing the explicit conditions under which a specific task would be implemented.

A weighted composite of the various scenarios will form the basis for equipment procurement and development, logistics arrangements, etc.

# Table 4. Proposed Response Tasks - New England Region

| TITLE | DESCRIPTION | PERFORMING ORGANIZATION | APPLICABLE HABITATS | APPLICABLE CONDITIONS | APPLICABLE OIL TYPE | TIME FRAME | COST | EQUIPMENT/FACILITY PERSONNEL NEEDS/AVAILABILITY | SUPPORT SERVICES | PAYOFF | LIMITATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| . Benthic Biology | | | | | | | | | | | |
| -1. Damage Assessment of -shore Rocky Intertidal | Assess immediate and long-term community changes | Woods Hole Normandeau UNH (Macrophyte) | Rocky intertidal | Oil impact Base data | All | 1 year minimum | $100,000 for 1 year study | Lab, small boat, taxonomists, - Generally available from performing organization | Hydrocarbon, Histopathology analysis | Immediate, long-term community impact | Weather, systematic expertise |
| -2. Damage Assessment of -Shore Soft-Bottom tertidal | Assess short and long-term community impact | Woods Hole UNH-JEL, URI, and others | Sandy beach, mud flat, marsh | Oil impact | All | 1 year minimum | $100,000 for 1 year. Then $50,000/yr. (variable) | Generally available from performing organization | Hydrocarbon, chemical, histopathology analysis, sediment work | Short and long-term effects | Taxonomic Expertise, high Demand on equipment, facilities |
| -3. Damage Assessment in allow Sub-Tidal Benthic mmunities | Assess short and long-term impact | Bigelow Lab, Normandeau, UNH, and others | Offshore bottom, worm-clam flats | Oil impact Base or control data | All | 1 year minimum 6 yr. max. | $200,000 for 1 year Then $100,000/yr. | Offshore sampler-vessel, lab space, systematic expertise - generally available | Sediment analysis, hydrocarbon in sediment, histopathology | Short and long-term effects | Taxonomic expertise, cost for a valid study |
| -4. Initial Assessment of mage on Offshore Benthic mmunities | Nature and extent of initial impact | URI, USCG, NUS, WHOI, NMFS, and others | Offshore bottom | Oil impact Base data | All | 1 month sampling | ~$200,000 | Offshore sampler-vessel, personnel, facility availability depends on previous commitment | Hydrocarbon analysis sediment analysis, histology | Document immediate impact | Weather, personnel, equipment availability |
| -5. Effects of Petroleum drocarbons/Dispersants Estuarine Communities der Flow-Through Lab nditions | Oil/Dispersant effects on developing and established communities | UNH-JEL, New England Aquarium | Sand or sand/mud | Icing may prohibit flow-through system | May not use crudes, #6 | 6 month total | $60,000 | Flow through system, benthic expertise | Need oil from spill site | Impact on developing and established communities | Icing, simulation of natural weathering of oil |
| -6. Effects of Oil on ecies Interactions: ging | Effects of oil on biological interactions | Woods Hole, UNH-JEL, and others | All benthic | All | All | 6 months | $15,000 ? | Caging equipment, benthic ecologists, lab space | Hydrocarbon analysis | Effects on community structure through species interactions | Weather |
| . Microbiology and Biodegradation | | | | | | | | | | | |
| -1. Effects of Petroleum drocarbons on Biodegrad- le and Heterotrophic tential of Marine Surface lms | Potential of microbes to degrade petroleum hydrocarbons | Energy Resource Co., Inc. URI-R. Taxler UNH-Galen Jones Univ. of R.I. | All marine and estuarine habitats, salt ponds, clam flats | Heavy seas Numerous samples Sufficient notice | Any type oil except very soluble fractions | Total 3 years | $31,000 (excludes ship costs) | Radioisotopes, benthic sampler, messenger shroud, lab, inflatable boat, ship, personnel | Hydrocarbon analysis, physical data, micronutrient levels, wind wave indicator | Gives information on biodegradation of hydrocarbons | Not directly useful in damage assessment |
| 2. Dispersants Toxicity Bacterial Population | To determine whether dispersants promote or inhibit biodegradation of hydrocarbon | Energy Resource Co. Univ. of N.H. - Galen Jones Univ. of R.I. - R. Taxler | All New England aquatic habitats | Seas $\leq 2$, sufficient size spill area, pre-spill period | Heavier oils, crude oils | 9 mos. | $8,000 - 39,000 | Same as above | Biochemical assays, physical data, | Determination of dispersant utility in minimizing oil spill damage to bacterial populations | Dispersants are not routinely used in U.S. |
| 3. Degradation in aerobic Sediments | To determine if degradation of hydrocarbons does occur in anaerobic sediments | Univ. of R.I. | Offshore bottoms, sand shores, worm flats, salt ponds | Uncontaminated sediment | Standard reference oils preferred | 3 yrs. | $32,000 | | | | |
| 4. Nutrient Enrichment | To determine potential adverse environmental effects, significant stimulatory effect upon hydrocarbon oxidation rate | Univ. of R.I., URI/GSO | | | | | | | | | |

Table 4. (continued)

| TITLE | DESCRIPTION | PERFORMING ORGANIZATION | APPLICABLE HABITATS | APPLICABLE CONDITIONS | APPLICABLE OIL TYPE | TIME FRAME | COST | EQUIPMENT/FACILITY PERSONNEL NEEDS/AVAILABILITY | SUPPORT SERVICES | PAYOFF | LIMITATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Birds and Marine Mammals | | | | | | | | | | | |
| . Assessment of Immediate Impact on Bird Populations in Spill Area | Air and surface observation of oiled birds | Manomet Bird Observatory, College of the Atlantic, Univ. of R.I. | All offshore habitats in EPA Region I | Observation of oiled birds | Any oil type | 1-3 mos. | $15,000 | Optical and recording material, aircraft, ship, 4 observers, generally available | Long-term and cause and effect studies | Immediate assessment of impact on marine birds | Dependent on necessary base-line info., highly mobile pop., weather & sea, unfeasible cost preditions |
| . Breeding Bird ulation Studies | Long-term approach to monitoring changes and trends in populations | USFWS, The Seabird Group, College of the Atlantic | Offshore islands, sandy beaches, bare cliffs, stacks | Availability of manpower, equipment, operation platforms | Not directly applicable | 10 year minimum | $30-32,000 each year of study | Binoculars, telescope, tripod, boat, trailer, trucks, field observers, principle investigators | Aerial reconnaissance of study area, aerial data | Long-range information on population changes | Large financial commitment, provides no short-term damage assessment information |
| . Collection, Classi- ation and Salvage of ected Oil Impacted ls | The collection and classification of oil impacted birds | U.S. Fish and Wildlife Service, Conservation and Humane Organizations | Pelagic; rocky shore; sandy shore; salt marsh; salt pond | Seastate ≤4 ft., physical accessability, bird presence, personnel availability | All types | 1 mo. | $60,000 | Plastic bags, scale, spotlight, truck, ATV/ACV, cardboard shipping boxes, burlap sacks, collection point, surface vessels | Rehabilitation of recoverable live birds, coordination of collection efforts | Satisfy public demand for the protection of birds in oil spill areas | Weather, seastate, terrain, collections dependent on mobility of birds |
| . Spill Effects on l Reproduction | Sub-"Investigate" for "Quantitative" | Univ. of Calif. Davis Dept. of Avian Sciences | Depends on species impacted | During breeding season | All types | 3-8 mos. | $17.6K | Lab, aircraft, living quarters, field biologists, lab biologist, principle investigator | Continued lab studies, baseline data on bird reproduction | Quantification of exposure, impact on reproduction | Limited to breeding season, few qualified techs., may not work on wild birds |
| Determination of .l Bird Mortality ı Post-Spill Body ıte | Using wave tanks, determine floating time for dead oiled birds | WHOI, URI-GSO | Primarily offshore | Funding and facilities | Crude, #2, #4, #6, Bunker C | 1 year | $50,000 | Wave tank, floating 'trap', glass ware, lab supplies, statistician, ocean engineer | Supports project 3-1 | Increases accuracy of bird mortality estimation from dead bird counts | Simulation of all sea and weather states may not be possible |
| Spill Impact on ne Mammals | A study of the effects of oil spills on marine mammals | NEA, URI, WHOI, NMFS, ERCO, Univ. of Maine | All but benthic | | | | | | | | |
| Birds and Mammals ct for Offshore Spills | Combined bird/mammal impact assessment | Manomet Bird Observatory, College of the Atlantic | Offshore only | Seastate ≤6 ft., birds, accessable air space | All oils | 4-6 wks. | $25-30,000 | Single lens reflex camera, cassette tape recorder, binoculars, aircraft, surface vessels | Tagging programs, base-line pop. research | Responds to public sentiment, gives assessment of immediate impact on birds and mammals | Lack of base-line data. Pop. are highly mobile. Weather and sea state |
| hemical Analysis nd Fate Panel | | | | | | | | | | | |
| Weathering of Oil ea | Study changes in hydrocarbon and nonhydrocarbon composition of spilled oil | Woods Hole, U.R.I., ERCO | Pelagic, salt ponds, estuarine | Good weather required | All types | 1-4 wks. | $30-50,000 | Sampling bottles, ship, analytical lab, air sampling gear | Physical Processes Panel must interact | Fundamental to any ecological assessment | Good sampling weather needed, good analytical schemes |
| Weathering of ıed Oil | Immediate and long-term study of chemical changes in stranded oil and chemical recovery of environment | ERCO, WHOI, URI, Bowdoin, EPA/Narragansett, NOAA NAF/Seattle | All except pelagic habitats | Beached or stranded oil in sediment | Any oil type | 5 yrs. | $55-100,000 | GC, GC/MS, grab sampler, jars, boat, sampling and analytical equipment | Must interface with microbiology prog. and benthic biologists | Relates chem. changes to changes in microbial and infaunal populations | Careful selection of sampling areas |

Table 4. (continued)

| TITLE | DESCRIPTION | PERFORMING ORGANIZATION | APPLICABLE HABITATS | APPLICABLE CONDITIONS | APPLICABLE OIL TYPE | TIME FRAME | COST | EQUIPMENT/FACILITY PERSONNEL NEEDS/AVAILABILITY | SUPPORT SERVICES | PAYOFF | LIMITATIO |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-3. Fate of Biologically Assimilated Oil | Designed to trace the chemical changes in biologically assimilated oil over time | Biol. Dept. of MBL, Taxon, and URI. Also ERCO and NOAA NAF for chemical analysis | Oyster-mussel reef, rocky shore, salt marsh, salt pond, clam flat | All conditions | All types | 5 years | $50-75,000 | Facility for storing animals, flow-through tanks, personnel, small boat | Must interface with histopathological studies | Better understanding of community response through chemical studies | Animals may naturally i Therefore, to mark and ganisms in area |
| 4-4. Monitoring Induced Aryl Hydrocarbon Hydroxylase Enzyme System in Teleost Fish and Infauna | Assaying for this enzyme important in assessing impacts of spilled oil | Environmental Conservation Div., NMFS/ Seattle, NMFS/ Woods Hole | All habitats where species are available | All conditions | Best for large quantities of aromatic hydrocarbons but can apply to all spill events | 1-4 wks. | $25-30,000 | Ship for traveling and dredging, analytical facilities, lab tech. | Should correlate with chemical analysis of PNA and histopathology | May give biochemical pollution indicator | Enzyme may activated b and other a compounds |
| 5. Physical Process Panel | | | | | | | | | | | |
| 5-1. Meteorological Observations and Analysis | To provide accurate observations of all weather conditions affecting cleanup efforts | National Weather Service, ships on the scene | All | All | All | 1-4 wks. | $20-30,000 | Van, radio, teletype, typewriter, telephone, 2 or 3 marine meteorologists | Good communication for rapid reporting of data | Provides OSC with accurate weather information for use in planning deployment of cleanup facilities | New England ther is dif cult to pre shortage of shore data |
| 5-2. Surface Mapping | To provide accurate surface maps to the regional response team | SOR Teams, ERDA, Coast Guard, Univ. of R.I., Chesapeake Bay Inst. | All | Favorable weather | All except gasoline | 1-4 wks. | $150,000 | Mini rangers, infra-red radiation thermometers, cameras, binoculars, charts, radio | Access to photo lab, teleprinter, xerox, typewriters | Info to On-Scene Coordinator, sampling teams, assessment of damage | Adverse wea surface map from aircra non-qualita |
| 5-3. Trajectory Forecasting/Hindcasting | Trajectory models to describe the distribution of spilled hydrocarbons | NOAA | All | Any time oil is spilled | All types | 1-6 mths. | $40-60,000 | Phone, computer terminals, drafting equipment, room or van, trained forecasters | Mapping of oil, detailed weather forecasts, local circulation data | Forecasts and hindcasts of oil movement | Needs appro ate backgro environment data (weath currents) |
| 5-5. Bottom Boundary Layer and Sediment Residence Time | Provides info. on duration of oil impact, direction of oil movements | USGA, WHOI, NOAA, MIT, Corps of Engineers | Offshore bottoms | Should be done as pre-spill study in high risk area | Any oil type | Short - long-term | $30,000/ month | Coring equipment, tripods, work boat, truck, computer facilities | Background on bottom sediment dynamic properties highly desirable | Map of bottom dynamic conditions of immediate use to OSC | Present kno not adequat to give qua tative numb |
| 5-7. Longshore and Rip Current Dynamics | Predictions of magnitude and direction of longshore and rip currents | Woods Hole, MIT, Univ. of Mass. | New England Surf Zone | Spill heading toward coastline | All | 1-4 wks. | $10,000 | E/M current meters, acoustic current meters, wave measuring devices, sediment sampling, small boat, computer, car | Mapping of spill, meteorological data, beach observations | Contribution to assessment and prediction of impact in coastal areas | Availabilit equipment, ther conditi present mod wind device Longshore c rents |
| 5-8. Coastal Current Studies | Predictions of magnitude and direction of coastal currents | Woods Hole, MIT, | Coastal Zone | Oil spill in shallow coastal region | All | 1-4 wks. | $10,000 | E/M current meter, CTD measurements, bottom cameras, ships, computer | Mapping of spill, meteorological data | Contribution to assessment and prediction of impact in coastal areas | Availability current mete weather cond tions |

Table 4. (continued)

| TITLE | DESCRIPTION | PERFORMING ORGANIZATION | APPLICABLE HABITATS | APPLICABLE CONDITIONS | APPLICABLE OIL TYPE | TIME FRAME | COST | EQUIPMENT/FACILITY PERSONNEL NEEDS/AVAILABILITY | SUPPORT SERVICES | PAYOFF | LIMITATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6.0 Fisheries/Water Column Biology | | | | | | | | | | | |
| 6.1 Bottom Trawl Operation | Monitor changes in species abundance. Collect species for physiol. biochem., path. genetic studies. | NOAA/NMFS in coop with EPA and State Canada, Poland, Fed. Rep. Germany, and the USSR | Georges Bank | Major Spills | All | 1-3 mo. | $200.0K | Research vessel with MARMAP; trawling and seining capabilities; exp. tab space for offshore spills; will use NOAA vessels ALBATROSS IV, DELAWARE II and coop. foreign ships. | Analytical support at sea or in lab. Coordinate with NOAA/NMFS Bottom Trawl Surveys, Nova Scotia to Cape Hatteras | Assessment of impact of spill on principal fish and invertebrate populations of the region | |
| 6.2 Demersal Food Chain Inv. | Food habits pathway studies of fish and selected invertebrates. | Same as 6.1 | Georges Bank | Major Spills | All | 1-3 mo. | $16.6K | Collection to be made in project 6.1 | Same as 6.1 | Same as 6.1 | |
| 6.3 Physiol. and Biochem. Effects | Collection of tissues for biochemical and physiological analyses. | NOAA/NMFS in coop with EPA | Georges Bank | Major Spills | All | 1-3 mo. | $20.0K | Collection to be made in project 6.1 | Same as in 6.1 | Same as 6.1 | |
| 6.4 Hydrocarbon Analyses | Analyses of time-series collections of fish, invertebrate, and zooplankton organisms and tissues for petroleum hydrocarbons and other toxic substances; collections will include samples from plankton nekton and benthos. | NOAA/NMFS in coop with EPA, URI, and WHOI | Georges Bank | Major Spills | All | 1-3 mo. | $158.8K | Collection to be made in project 6.1 | Same as in 6.1 | Same as 6.1 | |
| 6.5 Genetic Effects | Analysis of time-series collections of fish eggs for cytogenetic chromosomal damage. | NOAA/NMFS in coop. with EPA | Georges Bank | Major Spills | All | 1-3 mo. | $16.2K | Collections to be made in project 6.1 | | Same as 6.1 | |
| 6.6 Larval Fish Toxicity Studies | Experimental exposures will be conducted *in situ* in the spill site and in the laboratory on larvae most numerous during the spill. | NOAA/NMFS in coop with EPA, and Univ. of Kiel, FRG. | Georges Bank | Major Spills | All | 1-3 mo. | $16.0K | Collections to be made in project 6.1 | | Same as 6.1 | |
| 6.7 Phytoplankton Effects | Conditions of phytoplankton populations exposed will be determined using chlorophyl-phaeophytin relationships | NOAA/NMFS | Georges Bank | Major Spills | All | 1-3 mo. | $17.0K | Collections to be made in project 6.1 | | Same as 6.1 | |

Table 4. (continued)

| TITLE | DESCRIPTION | PERFORMING ORGANIZATION | APPLICABLE HABITATS | APPLICABLE CONDITIONS | APPLICABLE OIL TYPE | TIME FRAME | COST | EQUIPMENT/FACILITY PERSONNEL NEEDS/AVAILABILITY | SUPPORT SERVICES | PAYOFF | LIMITATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6.8 Hydrographic and Nutrient Environmental Effects | Observations will be made of changes in water column structure (temp. sal., $O_2$) current flow in surface and bottom water in area of spill. | NOAA/NMFS in coop. with WHOI, URI, USCG, and others. | Georges Bank | Major Spills | All | 1-3 mo. | $39.0K | Collections to be made in Project 6.1 | | Same as 6.1 | |
| 6.9 Ichthyoplankton Effects | Conditions of Ichthyoplankton and zooplankton population exposed will be determined with respect to changes in species composition and population densities. | NOAA/NMFS in coop. with Canada, Poland Fed. Rep. Germany, German Dem. Rep., USSR and other surveys. | Georges Bank | Major Spills | All | 1-3 mo. | $59.0K | Collections to be made in Project 6.1 | | Same as 6.1 | |
| 6.10 Fish Catch Analyses | Initiate survey of effects of spill on amounts and condition of fish landings. | Contracts to Fisherman Groups | Georges Bank | Major Spills | All | 1-3 mo. | $25.0K | Interviews to be conducted in all major N.E. ports | | Same as 6.1 | |
| 7. Histopathology Panel | | | | | | | | | | | |
| 7.1 Histopathological Effects of Oil Spills | Morphologic study of cells and tissues from oil exposed and control animals. | ERL, NMFS-NOAA, Univ. of R.I. | All | Major Spills | All | 2 yrs. | $100.0K | Field kit for specimen fixation, Histopathologic technique manual | Prediction of areas affected may coordinate sample collection with chemists | Increase knowledge of histopathology effects of oil on marine organisms | Sample collect and preservati baseline infor tion |
| 8. Oil Toxicity | | | | | | | | | | | |
| 8.1 Benthic Bioassay | Periodically remove impacted benthic assemblage from field to examine in the lab. | URI, U-Mass., Univ. of Maine, Univ. of N.H. | Clam/mud flats, offshore bottom | Demonstration of oil impact on community | All | 1 year | $150.0K | Benthic sampler, box core samplers, tanks, wet lab, cruise time | Analytical support for tissue and sediments | Assessment of initial damage, latent effects, and degree of recovery with time | Direct causal relationships may be difficult to verify |
| 8.2 Standardized Dispersant Toxicity Testing to Marine Biota | Conduct static acute toxicity test with petroleum/dispersants. | EPA-ERL | Salt marsh, shallow salt pond | N/A | All | 2 yrs. | $120.0K | Lab, static chamber, representative organisms | Chemical analysis | At present this data base is non-existent | Static system |
| 8.3 Oil/Dispersant Effects Under Simulated Field Conditions - Large Assay Containers | Current oil-dispersant toxicity evaluations are conducted using comparatively small static systems. | EPA-Edison, N.J., EPA-Narragansett | All | N/A | All | 1-3 yrs. | $150.0K-$300.0K | Six large tanks, holding facilities, analytical capability, histology and biochemical facilities | Chemical analyses of sediments, histopathology of selected organisms | Yields information about effects of oil, dispersants and oil/dispersant mixtures under simulated field conditions | Availability o facilities and expert personn |

Table 4. (continued)

| TITLE | DESCRIPTION | PERFORMING ORGANIZATION | APPLICABLE HABITATS | APPLICABLE CONDITIONS | APPLICABLE OIL TYPE | TIME FRAME | COST | EQUIPMENT/FACILITY PERSONNEL NEEDS/AVAILABILITY | SUPPORT SERVICES | PAYOFF | LIMITATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8-4. In Situ Acute Toxicity Tests | Collection of indigenous species from field site and exposure in lab to oil-contaminated water to determine toxicity | EPA, EG&G Bionomics | Near shore or offshore depending on location of mobile lab | Benthic system impacted | Any type of oil | 1-3 wks | $10-30,000 | Mobile lab fully equiped, work boat, experienced personnel | Collection of test organisms | Determine acute toxicity of oil under field conditions | Heavy seas, strong winds, heavy ice |
| 8-5. Time Dilution Bioassay on Holoplankton and Meroplankton | Utilize actual spill dispersion info to assess the acute impact upon selected species of marine holoplankton and meroplankton | EPA-Narragansett, EG&G, Marine Research Resources | Pelagic habitats either near shore or offshore | Detailed field and lab analytical data required | Oil with high dispersability and high WSF | 1-2 mos. | $10,000 | Dosing system, analytical lab, bioassay facilities | Analytical chemistry, culture of test species | Produces hard scientific data for acute, chronic and latent effects under field observed concentrations | Plankton may constitute a major problem due to patchiness and high reproductive potential |
| 8-6. Sublethal Effects of Chronic Exposure in Zooplankton | To determine effects of realistic sublethal concentrations of petroleum oils on zooplankton feeding and growth | Bowdoin College Marine Research Lab, and Dept. of Chemistry | Coastal, inshore and offshore waters | Flow-through dosing apparatus | All oils | 1 year | $125,000 | Flow-through apparatus, physiological equipment, CHN analysis, boats, Chemistry Dept. | Nutrient samples | Long-term effects of sublethal concentrations of petroleum HC's on marine organisms determined | Must be long-term, each apparatus ($25K ea.) works with one oil type at a time |
| 8-7. Effects of Oil Tainting of Prey on Feeding Behavior of Two Fish | Lab behavior study using oiled prey items | EPA-in house project | Rocky shore and offshore bottom | Oil impact on rocky intertidal area | Any heavy oil | 2 years | $30,000 in house - EPA | Supplied by EPA | Body burden analysis of pooled oil-tainted prey | Increase understanding of predator-prey interactions and assess the effects of oil tainting on feeding behavior | Prey should be obtained after clean-up if possible |
| 8-8. Effects of Spill Contaminated Sediment on Reproduction of Winter Flounder | Lab and field study investigating effects of oil exposrue on flounder reproductive success | Environmental Research Lab, Narragansett | Shallow salt pond, worm-clam flat | Presistent incorporation of oil into the sediment | Any oil with potential for incorporating into sediment | 1-2 yrs. | $20-30,000 | Large tank, ten gallon aquaria, sediment collection equipment, 2 otter trawls | Completed sediment contamination surveys of spill area | Study will indicate impact of an oil spill on winter flounder reproductive success | Flonder may avoid spill si[illegible] |
| 8-9. Effects of Chronic Exposures to Oil on Representative Marine Animals | Measuring growth and development of fish after after simulated animals exposure of oil spills | EPA, Bionomics, EG&G | Any habitat | Must work with species successfully cultured in a lab | All types of oil | 6-12 mos. | $75,000 | Appropriate exposure aquaria, water quality measurement apparatus, lab, investigators | Analytical chemistry | Define long-term effects of oil spills on marine animals | Only one speci[illegible] could be teste[illegible] in any study |
| 9.0 Socioeconomic and Legal Aspects Panel | | | | | | | | | | | |
| 9-1. Overview of the Maritime Socioeconomic Activities of the Region by Subregion | Provide full description of the industrial use of the marine environment | CZM Offices, Univ. of Maine, URI, MIT | | | | 1 year | $80,000- 20,000/5yr. updates | | | Study will provide overview of maritime socioeconomic activities | |

Table 4. (continued)

| TITLE | DESCRIPTION | PERFORMING ORGANIZATION | APPLICABLE HABITATS | APPLICABLE CONDITIONS | APPLICABLE OIL TYPE | TIME FRAME | COST | EQUIPMENT/FACILITY PERSONNEL NEEDS/AVAILABILITY | SUPPORT SERVICES | PAYOFF | LIMITATIONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -2. Base Line Study of ommercial Fisheries | Examine structure of industry | NOAA/NMFS, NEFMC, WHOI, URI | | | | 2 years | $300,000-12,000/1 yr. updates | | | Assessment of socioeconomic impact on fishing industry | |
| -3. Base Line Study of he Fish Processing ndustry | Provide statistics by species and source | WHOI, URI, SMU, Univ. of Maine | | | | 1 year | $40,000-6,000/yr. updates | | | Impacts of oil pollution on fish industry | |
| -4. Base Line Study of ish Trucking | Mapping of fish distribution networks | Univ. of Mass., WHOI | | | | 3 mos. | | | | Provide industry estimate if oil pollution caused a shift in fishing grounds | |
| -5. Base Line Study of etailing | Provide analysis of the sources of fish supplied | Univ. of Mass., URI, WHOI | | | | 4 mos. | $20,000-2.5K/5 yr. updates | | | Assess structure of industry affected if fish were tainted | |
| -6. Base Line Study of e Recreational Boat ndustry | Description of size and location of recreational boating facilities | URI, MIT, WHOI, SMU, Univ. of Maine | | | | 9 mos. | $30,000 | | | Identification of use of recreational boating facilities | |
| -7. Base Line Study of orts Fishing | Description of size and location of fishing areas | NOAA/NMFS, URI, WHOI | | | | 1 year | $60,000-60,000/5 yr. updates | | | Assess damage to sports fishing | |
| 8. Base Line Study of creational Use of orelines | Ascertain size and location of shoreline amenity areas | URI, WHOI, SMU, Univ. of Maine, Univ. of N.H. | | | | 6 mos. | $30,000-6,000/5 yr. updates | | | Assessment of value to user population | |
| 9. Base Line Research a Basis for Assessing gal Damage | Baseline research as a basis for assessing legal damage | URI, SMU, WHOI | | | | 3 mos. | $20,000 | | | Evaluate damage assessment programs with respect to legal requirements and use of scientific data in court | |
| 10. The Cost-Effectivees of Oil Spill Clean-up erations | Identify cost-benefit of clean-up operations | USCG, EPA, URI, WHOI, SMU | | | | 3 mos. | $30,000 | | | Input to the review of national and regional plans | |
| 11. Socioeconomic Factors volved in Locating Oil ill Clean-up Facilities | Assess alternative sites proposed by USCG | URI, WHOI, Univ. of Maine | | | | 3 mos. | $25,000 | | | Avoidance of additional socioeconomic impact resulting from spill clean-up activities | |
| 12. Analysis of Oil ansportation | Identify greatest density oil movement areas | USCG, NOAA, URI, WHOI | | | | 3 mos. | $25,000 | | | Identification of vulnerable and high risk areas | |
| 13. Assessment of Socioonomic Damage Following ills | Develop assessment plan to specific spills | EPA, NOAA, URI, WHOI | | | | 3 mos. | $25,000 | | | Standardization of assessment procedures | |
| 14. Socioeconomic iorities for Protection Areas Vulnerable to Oil ills | Develop socioeconomic criteria for protection of specific sites | State CZM Offices, Regional Univ. | | | | 3 mos. | $25,000 | | | Identification (for OSC) of specific areas with high socioeconomic priority for protection | |

Table 5. Primary Program

| Primary Program | Cost | Comment |
|---|---|---|
| I. Monitoring movement of oil | | |
| A. Meteorological observations and analyses (5-1)[1] | $ 25 K | These projects are interdependent and most efficiently used as a unit to yield valuable information to OSC. |
| B. Surface mapping of spill (5-2) | $150 K | |
| C. Trajectory forecasting/ hindcasting (5-3) | | |
| II. Decomposition of oil | | |
| A. Weathering of oil at sea (4-1) | $ 40 K | May give good information to OSC, and data correlation with water column studies. |
| B. Weathering of beached oil (4-2) | $ 40 K/yr, $ 10 K/yr thereafter | If oil landfalls, this would provide valuable information to other long term studies. |
| III. Effects of oil in benthic systems | | One or more of these studies may be used depending on habitat impacted. |
| A. Rocky intertidal (1-1) | $100 K/yr | Costs are approximate for 1 year of work, - studies may continue 5-6 years at lower cost |
| B. Soft-bottom intertidal (1-2) | $200 K | Cost dependent on habitat impacted and areal extent of study |
| C. Sub-tidal (1-3) | $200 K (1 year study) $100 K/yr thereafter | $600 K total for a 6 year study. |

Table 5. Primary Program (continued)

| Primary Program (Continued) | | |
|---|---|---|
| D. Initial assessment of damage to offshore benthic populations (1-4). | $200K | Initial damage assessment only. |
| IV. Oil spill impact on fisheries | | |
| A. Bottom Trawl Operation (6.1) | | |
| B. Demersal Food Chain Inv.(6.2) | | |
| C. Physiol. and Biochem Effects (6.3) | | |
| D. Hydrocarbon Analyses (6.4) | TOTAL COST (A-J) $580K | Projects can be applied separately, but when combined give a comprehensive survey of effects - especially desirable if water column systems appear grossly impacted. |
| E. Genetic Effects (6.5) | | |
| F. Larval Fish Toxicity Studies (6.6) | | |
| G. Phytoplankton Effects (6.7) | | |
| H. Hydrographic and Nutrient Environmental Effects (6.8) | | |
| I. Ichthyoplankton Effects (6.9) | | |
| J. Fish Catch Analyses (6.10) | | |

Table 5. Primary Program (continued)

| Primary Program (continued) | | Cost | Comments |
|---|---|---|---|
| V. | Oil spill impact on reptiles, amphibians, birds, and mammals | | One of these two projects may be chosen depending on level of impact on birds and spill location. There is considerable overlap between the two projects. |
| A. | Assessment of immediate impact on bird populations in spill area (3-1) | $ 15 K | |
| B. | Birds and mammals impact for offshore spills (3-7) | $ 25 K | Cost dependent on spill location and possibility of sharing ship time. |
| VI. | Oil spill impact on vegetation | | |
| A. | Impact on salt marsh (1-2) | $200 K | Included in benthic study (1-2). |
| B. | Impact on grass bed | Not proposed | Study should be initiated if massive impact observed on listed systems. |
| VII. | Oil Toxicity | | |
| A. | <u>In situ</u> acute toxicity tests (8-4) | $ 20 K | May give useful information immediately to OSC. |

Table 6. Spill Dependent Program

| Spill Dependent Program | Cost | Comment |
|---|---|---|
| I. Monitoring movement of oil | | |
| A. Long shore and rip current dynamics (5-7)[1] | $ 10 K | May be very important when surf zone is impacted-yields ultimate fate of spilled oil. Will increase predictive capability in dealing with surf zone. |
| B. Coastal current studies (5-8) | $ 10 K | May be important when coastal zone (30-40 m) is impacted. Will increase predictive capability in dealing with oil in coastal areas. |
| II. Decomposition of oil | | |
| A. Fate of biologically assimilated oil (4-3) | $ 60 K | Investigates change and movement of petroleum hydrocarbons in a test organism. This data may be useful in predicting community response. Should be interfaced with other chemical and histopathological research. |
| B. Monitoring induced AHH in teleost and infauna (4-4) | $ 30 K | May provide biochemical indicator of exposure to oil. |
| C. Effect of petroleum hydrocarbons on biodegradation potentials and heterotrophic potential of marine and estuarine surface films and sediments (2-1) | $ 31 K | Would give very important information about microbial degradation of spilled oil. Fundamental importance in understanding impact on benthic systems. |
| D. Dispersant toxicity to hydrocarbon degrading bacteria (2-2) | $ 15 K | Gives information on the effects of dispersants on microbial degradation of hydrocarbons. |

Table 6. Spill Dependent Program (continued)

| | | | |
|---|---|---|---|
| | E. Degradation in anaerobic sediments (2-3) | $ 32 K | Gives information about microbial degradation in anaerobic sediments, therefore is especially important in low energy areas (salt marsh, mud flat). Corollary experiments may be conducted independently of spills. |
| III. | Effects of oil on benthic systems | $ 75 K/ first year | Yields histopathological information on cause of death and chronic effects of oil. May increase predictive abilities if linked with chemical analyses. |
| | A. Histopathological effects of spilled oil (7-1) | $ 25 K/ 2nd yr. | |
| | B. Effects of oil on species interactions: caging (1-6) | $ 15 K | Provide information on the effects of oil on biological interactions within a community. |
| IV. | Oil spill impact on water column systems | | |
| | NO PROJECTS | | |
| V. | Oil spill impact on reptiles, amphibians, birds, and mammals | | |
| | A. Collection, classification, and salvage of suspected oil impacted birds (3-3) | $ 60 K | Rehabilitate distressed birds, provide specimens for chemical, pathological work, definite (minimum) mortality count. |
| | B. Effects of oil spills on bird reproduction (3-4) | $ 18 K | Examine specific effects on reproduction-if birds are impacted during breeding season. |
| | C. Spill impact on mammals (3-6) | $ ? K | Recommended if marine mammals obviously impacted. |
| VI. | Oil spill impact on vegetation | | |
| | NO PROJECTS | | |

Table 6. Spill Dependent Program (continued)

| | | |
|---|---|---|
| VII. Oil Toxicity | | |
| A. Benthic bioassay (8-1) | $150 K | Lab analysis of effects of progressive dosing in the field. May consider populations or communities. |
| B. Effects of oil tainting of prey on feeding behavior (8-7) | $ 15 K/yr for 2 yrs. | Investigates impact of oil tainting on feeding grounds of commercially important fish by examining oil effects on feeding behavior in the lab. |
| C. Effects of spill contaminated sediment on reproduction of winter flounder (8-8) | $ 20 K/ first yr. $ 10 K/ 2nd yr. | Indicates impact of spilled oil on flounder reproductive success. |

Table 7. Spill Independent Program

| Spill Independent Program | Cost | Comment |
|---|---|---|
| I. Monitoring movement of oil | | |
| A. Algorithm research for trajectory modeling (5-3)[1] | $ 50 K/yr. for 3 yrs. | Will increase accuracy of prediction in trajectory models, specifically oil thickness distribution and large scale spreading. |
| II. Decomposition of oil | | |
| A. Nutrient enrichment (2-4) | $ ? K | Describes effects of nutrient enrichment on microbial degradation. Project not fully detailed. |
| III. Effects of oil on benthic systems | | |
| A. Effects of petroleum hydrocarbons and/or dispersants on estuarine communities under flow through laboratory conditions (1-5) | $ 60 K | Lab study giving effects of dispersants and oil on developing and established benthic communities. |
| IV. Oil spill impact on water column systems | | |
| NO PROJECTS | | |
| V. Oil spill impact on reptiles, amphibians, birds, and mammals | | |
| A. Breeding bird population study (3-2) | $ 30 K/yr for 10 yrs. | Gives data on long term fluctuations in bird populations. |
| B. Determination of spill bird mortality from post-spill body counts (3-5) | $ 50 K | Increase accuracy of mortality estimates from post spill body counts. |

Table 7. Spill Independent Program (continued)

| | | | |
|---|---|---|---|
| VI. | Oil spill impact on vegetation | | |
| | NO PROJECTS | | |
| VII. | Oil toxicity | | |
| | A. Standardized dispersant toxicity testing to marine biota (8-2) | $120 K | Lab toxicity studies of dispersants, oils, and oil-dispersant mixtures. Results would be ultimately of use to OSC in application of dispersants. |
| | B. Oil/dispersant effects under simulated field conditions - large assay containers (8-3) | $200 K/ first yr. $100 K/ 2nd yr. | Extension of project 8-2 with effects tested in large, deep, flow through containers. |
| | C. Time dilution bioassay on holoplankton and meroplankton | $ 10 K | Uses dosage model obtained from real spill data to test effects on holoplankton and planktonic larvae in flow through lab. |
| | D. Sublethal effects of chronic exposure in zooplankton | $125 K | Lab work to determine long term sub-lethal effects, productivity changes, food chain distribution, temperature effects. |
| | E. Effects of chronic exposure to oil on representative marine animals (8-9) | $ 75 K | Cost depends on animal studied and duration of life cycle. Examines effects of chronic exposure to oil. |

## FUNDING REQUIREMENTS

### NOAA Internal Funding

NOAA funding requirements for FY1979-80 are indicated in Table 8.

Table 8. Projected Funding Requirements - NOAA

| | FY 1978 | FY 1979 | FY 1980 |
|---|---|---|---|
| Salaries and Benefits -- Project Office/Science Support Coordinators | $150K (3) | $450K (9) | $500K (9) |
| Project Office/SSC Travel | 30K | 75K | 75K |
| Purchase of Equipment and Supplies | 10K | 800K | 400K |
| Transport of Equipment | 10K | 75K | 75K |
| Data Collection and Sample Analysis | 100K | 125K | 125K |
| Training | 25K | 150K | 150K |
| | $325K | $1675K | $1325K |

NOAA funding is required to support management and administrative costs as well as operational activities which are beyond the scope of the "Pollution Fund." This latter category encompasses all activity undertaken in preparation for a spill response as well as certain response efforts under taken where conditions regarding use of the fund are not met, i.e., situations in which the Federal government does not intervene in the containment or clean-up effort.

NOAA internal funding requirements for FY1979 are described below:

*Salaries and benefits - Project Office/SSC staff*

Salary requirements for the Project Office and SSC Staff are included in this budget category.

*Project Office/SSC Travel* - This category includes travel in support of planning activities as well as response operations. This estimate is subject to considerable uncertainty depending on the number and scope of response activities required. The estimate is based on response to 4 major (>100,000 gal.) and 20 medium (<100,000 gal.) spills in FY1979.

*Purchase of Equipment and Supplies* - Because FY1979 will be the first full year of program implementation, a major expenditure of funds will be required. Projected requirements for FY1979 are as follows:

| | |
|---|---|
| Mobile Meteorological Vans (2) | $140,000 |
| Field Laboratory Facilities (2) | 200,000 |
| Sampling Equipment | 80,000 |
| Field Analytical Equipment | 120,000 |
| Communications Equipment | 50,000 |
| Data Processing Equipment | 100,000 |
| Supplies | 110,000 |
| | $800,000 |

The equipment requirement will decline in future years as non-expendable items of equipment are acquired.

*Transport of Equipment* - Equipment pools will be maintained at locations subject to highly probable spill occurrences as well as in other key deployment centers throughout the United States. In order to minimize equipment purchases, however, considerable air transportation expense is anticipated. The estimate for equipment transportation is based on costs incurred during the *Argo Merchant* spill.

*Data Collection/Sample Analysis* - This category includes costs incurred by NOAA and contract personnel during spill situations where conditions surrounding use of the "Pollution Fund" have not been met. Also included in this category are pre-spill studies and other activities that are necessary to support future responses, e.g., preparation of critical area maps, etc.

*Training* - It is anticipated that over 75 individuals will be trained in a given year in response procedures and the use of specialized sampling and analytical technology. Most training will be centered at Santa Barbara, California, where natural oil seeps provide an ideal setting in which to simulate response operations.

Pollution Fund Requirements

Only very general estimates are possible regarding requirements on the Pollution Fund in a given year. Reimbursement of expenses from the fund may be authorized only by the On-Scene Coordinator and then only in situations in which actions taken by the spiller in containment and clean-up are considered by the OSC to be inadequate. If these conditons are met, scientific activity which directly supports OSC operations relative to containment and clean-up may be reimbursed.

The Clean Water Act Amendments of 1977 have the effect of broadening the Fund to encompass certain liability and damage activities.

Based on 4 major (>100,000 gal.) and 20 medium (<100,000 gal.) spills per year requiring OSC support, as well as support to EPA in damage assessment, it is anticipated NOAA requirements on the fund to be about $4 million annually.

## PERSONNEL REQUIREMENTS

Table 9 indicates the present and required assignment of personnel to direct response functions within NOAA.

Table 9. Projected FTP Staffing Requirements

| | Current | Year-end FY 78 | Year-end FY79 | Year-end FY 80 |
|---|---|---|---|---|
| Office of AA/R&D | 1 | 1 | 1 | 1 |
| Project Office | 2 | 3 | 4 | 4 |
| Regional Scientific Support Coordinators | 2 | 4 | 5 | 5 |
| Response Personnel* | | | | |
| ERL Laboratories | 2 | 4 | 7 | 7 |
| NMFS Centers/Regions | 2 | 5 | 9 | 9 |
| NWS Regions | 1 | 2 | 4 | 4 |
| EDS | 1 | 1 | 1 | 1 |
| TOTAL | 11 | 20 | 31 | 31 |

*Requirements stated in personnel equivalents; each equivalent represents 2 to 4 individuals with part-time response functions.

*Project Office* - The Project Office in Boulder, Colorado will maintain a minimum full-time staff to coordinate national planning and provide centralized support of response team scientific, logistic and administrative operations. The staff will be expanded incrementally as the Project moves into operational phases. The following positions will ultimately be required:

| | |
|---|---|
| Project Manager | GS-15 |
| Marine Scientist | GS-14 |
| Logistics Specialist | GS-12 |
| Secretary | GS-5 |

*Regional Science Support Coordinatiors* - Regional SSC's are currently in place in Alaska and the Gulf of Mexico. In FY1978 additional positions will be required for the East and West Coasts; in FY1979 one additional position will be required for the Great Lakes. These positions are typically filled by biologists or oceanographers at the GS-13/14 level.

*Response Personnel* - Several full-time staffing equivalents will be required to provide adequate NOAA participation on response teams. Each equivalent generally represents 2 to 4 individuals with part-time response assignments. These individuals, drawn from other pollutant-related assignments during response periods will fill the following functions:

ERL Laboratories - Specialists in pollutant trajectory modelling and physiochemical interactions.

NMFS Centers/Regions - Specialists in fisheries ecology, laboratory toxicity, chemical analysis and damage assessment.

NWS Regions - Specialists in meterological forecasting and trajectory analysis and interpretation.

EDS - Specialists in data management.

Grade levels for the above positions will range between GS-11 and GS-14.